federal register

Monday,
April 30, 1979

Part IV

Department of Energy

Federal Energy Management and Planning Programs; Proposed Methodology and Procedures for Life Cycle Cost Analysis of Federal Buildings

DEPARTMENT OF ENERGY

[10 CFR Part 436]

Federal Energy Management and Planning Programs; Proposed Methodology and Procedures for Life Cycle Cost Analysis of Federal Buildings

AGENCY: Department of Energy.

ACTION: Notice of Proposed Rulemaking and Public Hearing.

SUMMARY: The Department of Energy proposes a methodology and procedures to conduct life cycle cost analyses involving estimation and comparison of the cost effects of replacing building systems with energy-saving alternative building systems in existing Federal buildings or of selecting among alternative building designs containing different energy using building systems for a new Federal building. The methodology will be subpart A of the new Part 436 of Title 10 of the Code of Federal Regulations and will be used in accordance with the guidelines for Federal building plans to reduce consumption of scarce fossil fuels for building energy use and with the rule for solar demonstration project proposals which will be subparts C and D of part 436, respectively.

DATES: Comments must be received by June 29, 1979, 4:30 d.s.t., in order to ensure their consideration. Hearings will be held at the places and on the dates indicated below.

ADDRESSES: Comments to: Margaret W. Sibley, Office of Conservation and Solar Applications, Department of Energy, 20 Massachusetts Ave., N.W., Washington, D.C. 20585.

HEARINGS: Public Hearings will be held in three cities, beginning at 9:00 a.m. local time on the dates and locations specified below:

City	Hearing date	Request to testify by 4:30 p.m.	Submit requests to testify to—	Hearing locations
San Francisco	May 17	May 7	Robert Laffel, DOE, 1111 Pine Street, San Francisco, CA 94111.	Holiday Inn, Golden Gate Way, 1500 Van Ness Ave., San Francisco, CA.
Kansas City	June 4	May 24	Suzanne Mathews, 324 East 11th Street, Kansas City, MO 64106.	Conference Rm. 140, 601 E. 12th St., Kansas City, MO.
Washington, D.C.	June 19	June 7	Margaret Sibley, DOE, 20 Mass. Avenue, N.W., Wash., D.C. 20461.	Room 2105, 2000 M Street, N.W., Washington, D.C.

FOR FURTHER INFORMATION CONTACT:

Jack Vitullo, Office of Conservation and Solar Applications, Department of Energy, 20 Massachusetts Avenue NW., Washington, D.C. 20585, (202) 376–4017.

Margaret W. Sibley, Office of Conservation and Solar Applications, DOE, 20 Massachusetts Avenue NW., Washington, D.C. 20585, (202) 376–1651.

Neal J. Strauss, Office of the General Counsel, DOE, 20 Massachusetts Avenue NW., Washington, D.C. 20585, (202) 376–9472.

Mark Friedrichs, Office of Policy and Evaluation, Department of Energy, 12th & Pennsylvania Ave. NW., room 5316, Washington, D.C. 20461, (202) 633–8595.

SUPPLEMENTARY INFORMATION:

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I. Introduction

The Department of Energy (DOE) hereby proposes to add a Subpart A to Part 436 of Chapter II, Title 10 of the Code of Federal Regulations (10 CFR Part 436). Part 436 will eventually comprise the rules for energy conservation and renewable energy (e.g., solar) programs applicable to Federal buildings. Today's proposal involves a methodology and procedures for the conduct of life cycle cost analyses to evaluate and compare the estimated cost effects of energy-saving investments in existing and new Federal buildings for the purpose of reducing consumption of scarce fossil fuels. The DOE proposes this life cycle costing methodology and procedures pursuant to section 381(a)(2) of the Energy Policy and Conservation Act, as amended, 42 U.S.C. 6361(a)(2), section 10 of Executive Order 11912, as amended, (Executive Order) and Title V of the National Energy Conservation Policy Act (NECPA), 92 Stat. 3275.

The DOE has already proposed a Subpart D for Part 436 which is intended to provide the rules for the Solar in Federal Buildings Demonstration Program under Title V, Part 2 of the NECPA. The DOE expects to add to Part 436 a Subpart B for preliminary energy audit procedures and a Subpart C for guidelines for Federal agency plans to reduce building energy use under the Executive Order and Title V, Part 3, of the NECPA. Subsequent to the proposal of Subparts B and C, the DOE intends to propose a Subpart E for Part 436 which will provide rules for monitoring and assessing the performance of photovoltaic solar electric systems to be installed at Federal facilities under Title V, Part 4 of the NECPA.

The life cycle costing methodology and procedures of Subpart A will be used to evaluate and compare the estimated cost effects of energy-saving investments during the formulation and execution of Buildings Plans under Subpart C. Subpart A will also be used to evaluate and compare the estimated cost effects of solar demonstration project under Subpart D. It should be emphasized, however, that the result of a life cycle cost analysis will be treated differently under Subparts C and D as required by law. The result will be determinative under the planning guidelines of subpart C, while, under Subpart D, it will merely be a factor to be considered in evaluating a proposed solar demonstration project.

Both the Executive Order and Title V of the NECPA set requirements for the methodology and procedures proposed today. Read together, they require that the methodology and procedures be practical, effective, and suitable for estimating—

- Whether retrofitting an alternative building system to an existing Federal building is cost effective and tends to minimize the life cycle cost of that building;
- Relative ranking, based on cost-effectiveness, of retrofit investments in Building Plans;
- Whether an alternative building design for a new Federal Building will minimize the life cycle cost of that building;
- Payback time for solar demonstration projects; and
- Present value of net benefits or excess costs of a solar demonstration project in comparision to a substitute conventional, non-solar alternative building system in an existing Federal building or in the design of a new Federal building.

In compliance with the Executive Order and the NECPA, proposed § 436.11 defines the term "life cycle cost" to mean "the total costs of owning, operating, and maintaining a building over its useful life, including its fuel and energy costs, determined on the basis of a systematic evaluation and comparison of *alternative building systems* * * *" [Emphasis added.]. Today's proposed rule defines the term "alternative building system" as "an energy conservation measure as defined by § 436.41, including a renewable energy system, for an existing Federal building, or a primary energy-saving building system, including a renewable energy system, for consideration as part of the design for a new Federal building." The DOE considered defining the term "alternative building system," to include only those systems which can attribute at least 50 percent of their projected overall cost savings to energy cost savings, but chose instead to leave the fixing of a precise cutoff point to agency discretion.

Today's proposal was developed in consultation with the Office of Management and Budget (OMB), the National Bureau of Standards (NBS), the General Services Administration (GSA), the Department of Defense (DOD), the Veterans Administration (VA), and other Federal agencies who, among other things, provided information on existing analytical techniques used to estimate life cycle cost. The Director of OMB has concurred in the proposal.

Substantial technical assistance was provided by the experts of the NBS who are conversant with the technical aspects of life cycle cost analysis and are established consultants in the field. NBS was instrumental in the development of a manual for Federal agencies to use in applying the rule. The manual is entitled "Life Cycle Cost Manual for Federal Energy Management and Planning Programs." A draft of that manual is available for inspection in the public file.

Today's proposed rule, when finalized, will promote standardization in life cycle cost analytical techniques already in use by Federal agencies. The final rule is likely to promote energy conserving investment decisions which are more consistent and rational. It may also influence private sector decisionmakers to balance the importance of initial investment costs with the implications of compensating cost savings over the life cycle of an investment in energy-saving building systems and building designs.

II. The Proposed Life Cycle Cost Methodology

A life cycle cost "methodology" is a set of systematic procedures which makes apparent the tradeoffs between additional dollars invested today and reduced costs tomorrow. The methodology permits an analyst to assess a give investment decision or choose among alternative investment decisions on the basis of the estimated economic consequences (measurable in dollars) over a given period of time. It involves analyzing the net effect of all significant cash flows associated with an investment over a period of time, using an adjustment "technique" to reflect the fact that the future dollar consequences of a present dollar investment can be accurately assessed only by taking account of the influence of time on the value of money. Dollars invested can earn a return over time, and it is this earing potential which determines the time value of money.

The DOE considered two closely related "techniques" for accounting for the time value of money: discounting future dollars to present values, and alternatively, converting present and future dollars to uniform annual values. Under certain circumstances, the uniform annual value technique is advantageous due to simplicity in computation. However, that advantage appears to be lost if one systematically escalates energy cost figures to take account of the prospect for long term increases in the price of most fossil fuel energy sources at a rate faster than the rate of increase in the general level of prices. Moreover, proposing a methodology with this technique would result in additional computation for the solar demonstration program authorized by Part 2 of Title V of the NECPA which requires an evaluation of the present value of benefits and costs. The additional computation would be the arithmetic conversion from annual value to present value. Inasmuch as the DOE considers adjustments to reflect rising energy prices to be essential and in light of the desirability to minimize the required calculation generally and for the NECPA solar demonstration program specifically, the DOE decided to propose use of present values.

The methodology proposed today employs the technique of discounting future costs to present values over a period of time referred to as a "study period". It involves different combinations of present value cost data to measure the cost effectiveness of energy-saving investments. The combinations of cost data are referred to as "modes of analysis," and are described as "total life cycle costs," "net savings," and the "savings-to-investment ratio."

In addition to these measures of cost effectiveness, the DOE proposes a procedure for calculating estimated simple payback time. Simple payback is a rough approximate indicator of cost effectiveness. It is not, however, a true measure of life cycle cost effectiveness because the calculation ignores cost savings and costs after the point in the life cycle at which cumulative cost savings equals investment costs. Moreover, although simple payback has the advantage of computational simplicity, it does not take into account the time value of money or anticipated increases in energy prices. The DOE is including it in the proposed rule because calculation of payback time is required for the solar demonstration program and may be useful as a rough indicator of cost effectiveness.

III. Developing Cost Data and Methodological Assumptions

A. Non-Fuel Use Cost Categories

Proposed § 436.16 identifies four categories of non-energy costs to be analyzed. These categories are: (1) investment costs; (2) non-fuel operation and maintenance costs; (3) replacement costs, and (4) salvage values. These categories cover the range of non-fuel use costs covered by the definition of the term "life cycle cost" in both the Executive Order and the NECPA.

The term "investment costs" is defined by proposed § 436.11 to include the initial costs of design, engineering, purchase and installation (exclusive of "sunk costs," that is to say, costs incurred prior to the life cycle cost analysis). Proposed § 436.14 provides for the assumption that the investment costs represent a lump sum occurring in

the base year which is the year is which the life cycle cost analysis takes place. This assumption is proposed for ease of computation.

The term "non-fuel operation and maintenance costs" is defined to include labor and non-fuel materials required for routine upkeep costs. Operating energy costs are excluded here, but included elsewhere, because the proposed rule provides for adjustments in future energy costs to reflect anticipated real price increases, but provides for no such adjustments of the non-energy costs. That feature of today's proposal made it desirable to separate energy from non-energy categories.

"Replacement costs" are defined by proposed § 436.11 as future costs to replace a building system or a component thereof which wears out during the study period.

"Salvage value" is defined by proposed § 436.11 as value of any building system removed or replaced during the study period, remaining at the end of the study period, or captured in resale if the building is to be sold before the end of the study period.

Proposed § 436.14 provides for Federal agencies to establish cost data for the foregoing categories by referring to standard estimating sources.

It is intended that Federal agencies only consider those costs of investment, non-fuel operation and maintenance, and replacement, and salvage values directly incurred by the Federal government. This is an important point to bear in mind with respect to leased Federal buildings when the lease does not provide for the United States or a Federal agency to pay for these costs.

B. Energy Cost Data

Proposed § 436.14(c) provides for Federal agencies to use the estimated base year energy prices indicated in Table 1, Appendix C, by appropriate region, sector, and fuel type, or, alternatively, their own base year energy prices if they exceed the DOE regional estimates.

Proposed § 436.17 provides for estimating energy costs, in accordance with § 436.14(c), on the basis of the energy delivered to the Federal building. For example, if a Federal agency is billed directly for electricity delivered to a particular building, the price of electricity to be used in calculating the life cycle costs of an alternative building system for that building is the base-year price indicated for electricity in Table 1, Appendix C, for the appropriate region and sector, unless the price actually charged by the utility is higher. However, if the Federal agency buys coal which is then used to generate electricity, the price of the electricity used in calculating the life cycle costs of an alternative building system should reflect the cost of the coal, plus the costs incurred by the agency in generating and distributing the electricity. If the total cost to the agency (including the cost of the primary fuel) of generating and distributing the electricity is higher than the the appropriate DOE regional price indicated in Appendix C, a unit price based on actual agency costs should be used. It is intended that Federal agencies only consider energy cost savings when the agencies are directly charged for the energy used in a building. This is a point to bear in mind when, with respect to leased Federal buildings, the lease does not privide for the United States or a Federal agency to pay for the costs of utilities.

The base year energy prices for 1980 were derived from actual prices obtained from DOE's Energy Information Administration (EIA) for the year 1977. These prices were then escalated and inflated to approximate actual 1980 prices by region, sector, and fuel type.

In the development of today's proposal, DOE considered a requirement that Federal agencies use base year energy prices and projected energy price escalation rates which reflect the replacement or marginal costs of producing and delivering additional supplies of energy rather than average retail prices. Such prices should reflect the cost savings to the Nation as a whole of energy conserving actions, rather than simply the cost savings to the Federal Government. It has been estimated that replacement costs prices, at the retail level, for electricity, natural gas, and petroleum products are currently 10–30 percent higher than actual retail prices. Because reliable projections of such replacement cost prices are not yet available, and DOE wants to solicit comments before proceeding, the proposed rule uses projections of average retail prices. DOE would welcome comment now on the desirability of using replacement cost prices. DOE is particularly interested in comments about (1) the accuracy of estimates of replacement cost prices (for electricity, natural gas, and petroleum products) that are 10–30 percent higher than actual costs, (2) how much the difference will narrow between average real prices and replacement costs as a result of the Natural Gas Policy Act of 1978 and oil decontrol, and (3) whether replacement costs reflect accurately the cost savings to the Nation of energy conserving actions. Prior to incorporating any replacement cost prices in future rulemakings, however, DOE will provide public notices of their availability for comment.

The projected energy prices and escalation rates used in today's proposal were developed from preliminary March 1979, results of the Mid-Term Energy Forecasting System (MEFS), developed by EIA. MEFS is an integrated computer model of the domestic energy system with explicit representation at the regional level of the supplies and costs of petroleum products, natural gas and coal; costs of petroleum refining, electricity generation, and transportation; and price sensitivity of energy demands. In forecasting future energy supply, demand and prices, MEFS simulates the effects of a number of different variables, such as economic growth, world oil prices and the discovery of additional domestic energy resources. In order to reflect the uncertainty of such forecasts, EIA develops a range of forecasts based on different assumptions about key variables.

The MEFS is the latest version of a model which was called Project Independence Evaluation System (PIES). PIES was fully documented in a 15 volume set of reports published in September, 1976. This documentation is available from the National Technical Information Service (NTIS), Springfield, Virginia 22161, under the number of the initial volume FEA/N–76/411. It is now being updated to document the Mid-Term Energy Market Model which is the basis of MEFS. Additional information about the model will be released in April by the EIA Administrator and will be available in the public file.

The projected energy price escalation rates used in these proposed rules represent the preliminary results of a forecast based on a series of "pessimistic" assumptions regarding long term world and domestic energy supplies. These "pessimistic" assumptions result in energy price projections on the high end of the range of forecasts being developed by EIA. For example, this high-price case assumes that the price in 1990 of crude oil on the world market (in constant 1978 dollars) will be $23.50. This is contrasted by a medium-price case which assumes the 1990 world oil price to be $18.50 and a low-price scenario which assumes the price will be $15.00.

As can be seen from recent movement in World Oil prices, the "high" case more closely reflects actual price trends than does the medium or low price cases. Therefore, DOE has selected the high price case as the most suitable at

this time for use in developing estimates and making energy conserving investments in Federal Buildings. DOE specifically invites comments on the choice of this high-price case. The price forecasts used in the final rule, to be issued later this year, will be adjusted to reflect the final results of EIA's most recent forecasts of energy prices, under the high-price case, subject to public comment. DOE plans annually to update these forecasts of energy prices, as well as the base year energy prices indicated in Table 1, Appendix C.

Specific assumptions upon which the high-price case is based, include:

1. Real (inflation adjusted) annual growth rate for the Gross National Product (GNP) will average 3.9 percent a year from 1980 to 1985 and about 3.3 percent per year thereafter.

2. Real price of oil imports, in 1978 dollars, will increase to $21.50 by 1985, to $23.50 by 1990 and to $31.50 by 1995.

3. The provisions of the National Energy Act are fully implemented.

4. Domestic oil prices are decontrolled by September 30, 1981.

5. There is no oil pipeline from the West Coast to eastern portions of the U.S.

6. A gas pipeline from Alaska would be in place by 1985.

7. The United States Geologic Survey low domestic resource base exists.

8. As gas prices rise, various non-traditional supplemental sources of natural gas become available.

A more detailed description of the assumptions, underlying the price forecasts in today's proposed rule will be contained in an Energy Information Administration memorandum of case assumptions which will be available in the public file. This document sets forth the assumptions for cases in addition to the high-price case used today. The basis for the different sets of assumptions for the range of forecasts by EIA will also be fully discussed in the annual report of the Administrator of EIA.

Data on the price growth are derived from the price projections. These include a rate for the period from 1979–1985 derived from the historical 1977 prices and the projected 1985 prices, a rate for the period 1985–1990 derived from the forecasts for 1985 and 1990 and a rate for years beyond 1990 derived from the 1990 and 1995 price forecasts. The energy price projections from which these escalation rates were derived are represented in constant 1978 dollars and, thus, disregard those price increases expected to result from general inflation alone. The use of these "real" energy price escalation rates is in conformance with the requirements of OMB Circular A–94 and accepted life cycle costing techniques. This approach, however, does result in escalation rates which are lower than the rates (including inflation) of energy price growth perceived by Federal agencies and other energy users. The following Tables show examples of escalated prices and inflated prices for each 5 years through 1995.

Escalated Prices (1980 Dollars)

Year	Elec.	Residential		Commercial Residual	Industrial Coal
		Nat. Gas	Distillate		
1980.....	14.17	3.24	4.38	3.20	1.15
1985.....	15.47	4.25	5.49	4.44	2.16
1990.....	15.96	4.91	6.02	4.93	2.28
1995.....	17.82	5.64	7.70	6.41	3.06
Inflated Prices (Current Dollars)					
1980.....	14.17	3.24	4.38	3.20	1.15
1985.....	21.08	5.79	7.48	6.06	2.93
1990.....	27.37	8.40	10.31	8.47	3.90
1995.....	38.27	12.09	16.52	13.79	6.55

Fuel prices per million Btu's. Assumed inflation rates 6.4 percent to 1985; 4.7 percent from 1985 to 1990, and 4.6 percent from 1990 to 1995.

C. Discount Rate and Constant Dollars

The annual discount rate proposed today for evaluating both energy-saving retrofit investments and new building designs under today's rule is 10 percent. This is the prescribed rate under OMB Circular A–94, and represents an estimate of the average rate of return on private investment before taxes. It is the standard rate for evaluating Federal programs and projects. The Executive Order requires that the life cycle methodology be consistent with OMB Circular A–94.

Consistent with OMB Circular A–94, the DOE is proposing that both costs and savings be expressed in constant dollars, that is, exclusive of the inflationary trends in the general level of prices in the economy.

Appendices A and B to this Part contain tables of present worth factors based on a 10 percent discount rate for adjusting future energy and other costs to present values. Tables 1 and 2, Appendix A, are used for adjusting future nonenergy costs to present values. Tables 1 through 11, Appendix B, which contain present worth factors adjusted for energy price escalation (as discussed below), are used for adjusting energy cost data to present values. This combined table simplifies the computation of life cycle cost data.

D. Study Period

The "study period" for owned existing and new Federal buildings, as well as leased Federal buildings is set forth as proposed § 436.14.

The proposed rule provides for the following study periods—

- The lesser of 30 years of project life or building life for evaluating or ranking alternative building systems for an owned existing Federal building;
- A common study period for comparing the total life cycle costs or net savings of mutually exclusive alternatives for a given building system, such as alternative sizes of a solar energy system, or alternative thicknesses of insulation;
- The lesser of 30 years or the period of intended use for evaluating alternative building designs for an owned new Federal building; and
- The effective remaining term of a lease, taking renewal options into account, as appropriate, for leased Federal buildings.

With respect to ranking retrofits, project life (where it is less than 30 years) instead of building life was selected as the study period for several reasons. First, use of project life makes calculation simpler due to elimination of multiple replacements of the entire project from consideration. Second, use of project life appears to focus more closely on the specific investment decision at hand rather than on future decisions to replace the project. In any event, it should be noted that the savings-to-investment ratio used to rank retrofits appears to be relatively insensitive to the choice of a study period between project life and building life. A common study period for all projects need not be used in calculating the savings to investment ratio.

The proposed rule provides that common study periods be employed in comparing the total life cycle costs or net savings of alternative building systems that are substitutable for the same building system, such as double-glazed and triple-glazed windows. The possibilities identified in proposed § 436.14(d)(2) are estimated useful life of one of the alternatives, a common multiple of the estimated useful lives of the alternatives, or the lesser of 30 years or the useful life of the Federal building. It is important to use a common study period for such mutually exclusive alternative building systems because the values for total life cycle cost and net savings will vary depending on the length of the study period. Comment on these alternatives and suggestions for improving this aspect of the methodology would be welcome.

E. Possible Special Solar Incentives

This rulemaking uses the same methodology to determine the life cycle cost of energy conservation and solar investments. This methodology is consistent with that used to determine the cost-effectiveness of many other non-energy investments made by the Federal Government. At this time, DOE wants to solicit comments about whether this approach is appropriate.

Consistent with this approach, DOE could consider external costs and benefits realized by the Nation, such as a reduction in environmental pollution. DOE is particularly interested in any comments about whether such external costs and benefits can be identified and quantified.

An alternative to this methodology that has been suggested, but not incorporated in the current rulemaking, is an approach that would provide a special adjustment for solar and other renewable energy systems being considered for new buildings. For example, the initial investment cost of a renewable energy system might be reducted to reflect the Federal renewable energy tax incentives made available to businesses and individuals.

Specifically, the Energy Tax Act of 1978 (Pub. L. 95–618) allows a 10 percent tax credit for business investments in a wide rage of renewable energy systems, and the Act provides a tax credit for up to 30 percent of the cost of renewable energy systems intalled in residences. Comparable adjustments could be made for renewable systems considered, respectively, for Federal non-residential and residential buildings. Some have argued that such adjustments should be made since the external benefits to the Nation cannot be quantified and the incentives in the Energy Tax Act can be used as a proxy for these benefits. DOE would welcome comment on the extent to which this argument has merit.

More generally, DOE would welcome comment about the desirability of using the above-mentioned alternative methodology for energy conservation measures and comment about any other special incentives that can be considered for energy conservation and/or renewable resource measures.

IV. Applying the Proposed Life Cycle Cost Methodology

A. Formatting Cost Data

A format for performing a life cycle cost analysis is commonly used to facilitate computations in developing cost data and presenting combinations of cost data to measure cost-effectiveness. The proposed rule encourages but does not require use of a format contained in the "Life Cycle Cost Manual for Federal Energy Management and Planning Programs." The Manual illustrates how to perform a life cost analysis with necessary calculations in compliance with the rule. As noted above, this manual is available in draft for inspection in the public file for this rulemaking.

Two alternative approaches to estimating life cycle energy costs are possible and were considered for today's proposal. One approach is a detailed, step-by-step calculation and summation of year-by-year energy costs, and the other is a simplified approach which computes life cycle energy costs in two calculation steps.

The year-by-year procedure adjusts for energy price escalation and the time value of money in two separate steps by first multplying the yearly physical quantity of energy saved by the constant dollar price per unit of energy for each year, and then multiplying each product by the appropriate single present worth discounting factors for that year. The total of life-cycle energy savings is then found by summing yearly present value energy savings over all years of the study period.

The alternative procedure uses uniform present worth factors preadjusted to reflect energy price escalation. By this two-step procedure, total life-cycle energy savings are found by multiplying the physical quantity of energy saved by the price per unit of energy in the base year and then multiplying the product by the adjusted uniform present worth factor for the appropriate study period.

The year-by-year procedure requires the projection of yearly energy prices over the study period, while the second requires the projection of rates of change in prices over the study period.

The year-by-year procedure offers the advantage of greater flexibility in evaluating projects that are expected to be significantly deferred in time. A futher possible advantage is the flexibility to pair the price tables and the discounting tables in the appropriate combinations as time passes. This means that the table remain usuable for successive years provided the energy price forecasts do not change. The disadvantage of this technique is the greater number of calculations required.

The two-step procedure offers the advantage of greater ease and simplicity in computation. Its disadvantage is that in relying on adjustment factor tables that combine energy price escalation and discounting, it is less flexible than the first procedure. Unless the energy price escalation rates on which it is based are smoothed over relatively wide intervals of time, annual updating of the adjustment factor tables may be required even if the energy price projections do not change.

Because of the expectation that most projects will be evaluated on the basis that they will be completed in the base year, flexibility in treating time-delayed projects is not considered of primary importance. Furthermore, because it is likely that annual revisions will be required to the energy prices and escalation rates regardless of the procedure adopted for calculating energy savings, the difference between the two procedures in their requirements for revisions to factor table does not appear substantial.

For these reasons, it was decided to suggest the two-step procedure as the method of calculating present value energy savings for the proposed rule.

B. "Modes of Analysis"—Combining Cost Data and Measuring Cost Effectiveness

The proposed rule provides for four "modes of analysis" which represent four different ways of combining and presenting some or all of the cost data over the appropriate study period. Each "mode of analysis" describes a measure of cost effectiveness and is useful for a specific part of the planning guideline program of Subpart C and of the solar demonstration program under Subpart D of Part 436, but no one of them is suitable for all parts. The uses of each "mode of analysis" are described in proposed § 436.18. The four modes of analysis for combining and presenting cost data are: "Total Life Cycle Costs" "Net Savings," "Savings-to-Investment Ratio," and "Estimated Payback Time." These four modes of analysis are described by proposed § 436.19–436.22, respectively, and they are standard descriptions.

The proposed rule does not attempt to set forth a rigorous set of computations for each "mode of analysis." As stated earlier, the "Life Cycle Cost Manual for Federal Energy Management and Planning Programs" provides samples and advice on determining results for all of them. The proposed rule would permit each Federal agency to compute results in conformance with the description of each "mode of analysis" and with the methodological assumptions discussed above.

One critical point about proposed § 436.18 should be underscored. It identifies the savings-to-investment ratio as the ranking criterion for establishing priorities among retrofits of

alternative building systems. Some have suggested that Btu savings per dollars invested, rather than dollar energy savings, should be emphasized in ranking retrofits. The planning guidelines of Subpart B will provide for using such a ratio as a means of ranking projects which are equally cost effective as indicated by the savings to investment ratios, but DOE has otherwise rejected this suggestion because the Executive Order provides for ranking strictly on the basis of life cycle cost and the NECPA ultimately requires minimization of life cycle cost for all Federal buildings. The intent is to make investment decisions on the basis of all cost effects and not just changes in the physical quantity of energy.

V. Retrofit Interdependencies

For existing Federal buildings, an objective of the economic analysis is to try to optimize, to the extent possible, both the energy conservation retrofit investments for a given building and the retrofit investments for all buildings across the government within the confines of the overall budget. Achieving these objectives requires accurate assessments of the energy savings that will result from particular energy conservation measures. When two or more conservation measures are likely to be budgeted for a particular building, such assessments should take into account the interdependencies of the measures. Some projects are so closely interdependent that a simultaneous solution of the design and sizing of the projects is necessary for maximum cost-effectiveness of the investments. For example, installing insulation in a particular building may reduce the fuel oil required for heating by 1,000 gallons per year. Replacing the furnace of that same building may also reduce fuel oil requirements by 1,000 gallons per year. However, adopting both measures would reduce fuel oil use by significantly less than 2,000 gallons per year because the two measures are interdependent. For another example, the optimal sizing of a solar energy system to provide energy and the optimal level of energy conservation investments to reduce energy requirements are decisions that need to be considered jointly in order to determine the economically efficient tradeoffs between the two. Decisionmaking would be improved by procedures for establishing cost-effectiveness which takes into account such interdependencies, but such procedures may add to the complexity of the analyses. Comments are invited on the manner in which interdependencies can best be reflected in agency project evaluations.

VI. Sensitivity Analysis

Because life cycle cost analysis deals with estimates, questions of uncertainty can arise with respect to the reliability of some of the cost data. The proposed rule provides for testing the "sensitivity" of a life cycle cost analysis to variations in cost estimates by assessing the relative impact of variations on the result. For example, if one were uncertain about the reliability of estimated replacement costs of an alternative building system for retrofit to an existing building, one could compute several savings-to-investment ratios for that system varying only the assumptions as to estimated replacement costs. The proposed rule would not require the conduct of a sensitivity analysis. Neither would it mandate the use of probability analysis although such an analysis might be indicated in the case of variable factors showing a high degree of variability for which probability estimates would be established.

VII. Leased Federal Buildings

The proposed rule is applicable to leased as well as owned Federal buildings. In performing a life cycle cost analysis under the rule, costs which are *not* paid by a Federal agency are excluded. Thus analysis of cost effectiveness for Federal buildings which have the same energy consumption characteristics may differ markedly depending on whether the Federal agency is the owner of the building or the lessee.

VIII. When To Assume Cost Effectiveness Results

The proposed rule permits assumptions as to results in certain narrowly defined circumstances without performing a life cycle cost analysis. Energy-saving investments are deemed not to be cost-effective for buildings under lease where the Federal agency does not pay the cost of utilities, and for buildings scheduled to be demolished or retired by fiscal year 1985. At the same time, an investment can be assumed to be cost-effective when the cost is insignificant and savings are relatively certain.

IX. Environmental review

A. *NEPA.* It has been determined that the promulgation of this rule *per se* does not constitute a major Federal action significantly affecting the quality of the human environment pursuant to the National Environmental Policy Act of 1969, as amended (NEPA) 42 U.S.C. 4321 *et seq.* As stated previously, when finalized, this rule will become subpart A of 10 CFR Part 436. Actions taken under Part 436 to implement this rule must be evaluated to determine the need for further environmental review so as to ensure full compliance with NEPA.

B. EPA Review

The DOE provided a draft of today's proposed rule to the Administrator of the Environmental Protection Agency for written comments concerning impacts on the quality of the environment, pursuant to section 7(a) of the Federal Energy Administration Act, as amended, 15 U.S.C. 766(a). The Administrator had no comments.

X. Determinations Under Executive Order 12044

Today's proposed rule has been reviewed under Executive Order 12044, 43 FR 12661, and is deemed to be "significant" because of the widespread impact on the Executive Branch. The proposed rule is not considered to be a major rulemaking because the rule is not expected to have the kinds of gross effects which call for a regulatory analysis. Accordingly, a comment period of 60 days is provided.

XI. Public File

A public file for this rulemaking is open to public inspection at the DOE in Room 8–G–152 of the DOE Freedom of Information Office, which is located at the Forrestal Building, 1000 Independence Avenue, SW., Washington, D.C. 20585. This file contains a copy of OMB Circular A–994, the draft "Manual for Life Cycle Cost Analysis," and a copy of "Life Cycle Cost Analyses—A Guide for Architects" (a useful introductory document prepared by a task force under the auspices of the American Institute of Architects). Additional materials of significance may be added to this file.

XII. Effective Date

The DOE proposes making the rule effective upon final publication because the methodology is to be used in conjunction with the planning guidelines of subpart C in order to constitute a set of rules governing the drafting of building plans to conserve building energy use. An expedited effective date is necessary in order to affect agency actions on a timely basis during the cycle for developing the Federal budget for fiscal year 1981 which will be ongoing throughout most of calendar 1979.

XIII. Comment and Hearing Procedures

A. Written Comments

Interested persons are invited to participate in this rulemaking by submitting data, views, or arguments with respect to the proposed procedures, standards, and criteria. Comments should be submitted to the address indicated in the addresses section of this preamble and should be identified on the outside of the envelope and on documents submitted to DOE with the designation "Life Cycle Costs—Proposed Rule (Docket No. CAS–RM–79–107)." Fifteen copies should be submitted. All comments received by June 29, 1979, and all other relevant information will be considered by DOE before final action is taken on the proposed regulations.

Any information or data considered by the person furnishing it to be confidential must be so identified and submitted in writing, one copy only. DOE reserves the right to determine the confidential status of the information or data and treat it according to its determination.

B. Request Procedures

The times and places of these public hearings are indicated in the dates and addresses section of this preamble. DOE invites any person who has an interest in the proposed rulemaking issued today, or who is a representative of a group or class of persons that has an interest in today's proposed rulemaking, to make a written request for an opportunity to make an oral presentation. Such a request should be directed to the address indicated in the addresses section of this preamble and must be received before 4:30 p.m. d.s.t.

May 7 for San Francisco hearing
May 24 for Kansas City hearing
June 7 for Washington, D.C. hearing

Such requests may be hand delivered to such address, between the hours of 8 a.m. and 4:30 p.m., Monday through Friday. A request should be labeled both on the document and on the envelope "Life Cycle Cost—Proposed Rule (Docket No. CAS–PM–79–104)." The person making the request should briefly describe the interest concerned; if appropriate, state why she or he is a proper representative of a group or class of persons that has such an interest; and give a concise summary of the proposed oral presentation and a telephone number where she or he may be contacted through the day before the hearing. DOE will notify each person selected to appear at the hearing, before 4:30 p.m. d.s.t.

May 10 for San Francisco hearing
May 30 for Kansas City hearing
June 11 for Washington, D.C. hearing

Each person selected to be heard must bring 15 copies of her or his statement to the hearing at the address given in the addresses section of this preamble.

C. Conduct of Hearings

DOE reserves the right to select the persons to be heard at this hearing, to schedule their respective presentations, and to establish the procedures governing the conduct of the hearing. The length of each presentation may be limited, based on the number of persons requesting to be heard.

A DOE official will be designated to preside at the hearing. This will not be judicial or evidentiary-type hearing. Questions may be asked only by those conducting the hearing, and there will be no cross-examination of the persons presenting statements. Any decision made by DOE with respect to the subject matter of the hearing will be based on all information available to DOE. At the conclusion of all initial oral statements, each person who has made an oral statement will be given the opportunity, if she or he so desires, to make a rebuttal statement. The rebuttal statements will be given in the order in which the initial statements were made and will be subject to time limitations.

Any person who wishes to have a question asked of a speaker at the hearing may submit the question, in writing, to the presiding officer. The presiding officer will determine whether the question is relevant, and whether the time limitations permit it be to presented for answer.

Any further procedural rules needed for the proper conduct of the hearing will be announced by the presiding officer.

A transcript of the hearing will be made, and the entire record of the hearing, including the transcript, will be retained by DOE and made available for inspection at the DOE Freedom of Information Office, Room 8G152, Forrestal Building, 1000 Independence Avenue, S.W., Washington, D.C. 20585, between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday. Any person may purchase a copy of the trasncript from the reporter.

In consideration of the foregoing, the DOE hereby proposes to amend chapter II of title 10, Code of Federal Regulations, by establishing Subpart A of Part 436 as set forth below.

Issued in Washington, D.C., April 20, 1979.

Kelly C. Sandy,
Executive Director Conservation and Solar Application.

Subpart A—Methodology for Life Cycle Cost Analysis for Federal Buildings

Sec.
436.10 Purpose.
436.11 Definitions.
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436.20 Net Savings.
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436.22 Estimated Simple Payback Time.
436.23 Sensitivity Analysis.
436.24–436.29 [Reserved]
Appendix A to Subpart A of Part 436—
Table A–1—Single Present Worth Factors for Discounting Future Non-Recurring Cost to Present Value (Based Upon A 10% Discount Rate).
Table A–2—Uniform Present Worth Factors for Discounting Future Non-Fuel Recurring Cost to Present Value (Based On 10% Discount Rate).
Appendix B to Subpart A of Part 436—
Uniform Present Worth Factor for DOE Regions I–X and the United States.
Appendix C to Subpart A of Part 436—
Table C–1—Base Year Energy Prices.
Table C–2—Base Year Energy Prices.
Table C–3—1985 Projected Energy Prices.
Table C–4—Projected 1990 Energy Prices.
Table C–5—1995 Energy Prices.

Authority: Energy Policy and Conservation Act, as amended, 42 U.S.C. 6361, Executive Order 11912, as amended, 42 FR 37523 (July 20, 1977); National Energy Conservation Policy Act, Title V, Part 3, 92 Stat. 3275; Department of Energy Organization Act, 42 U.S.C. 7254.

Subpart A—Methodology and Procedures for Life Cycle Cost Analysis of Federal Buildings

§ 436.10 Purpose.

This subpart establishes a methodology for estimating and comparing the life cycle costs of Federal buildings and for making determinations of life-cycle cost effectiveness. The methodology is to be used for evaluation of the economic consequences of investments in alternative building systems for existing Federal buildings and alternative building designs for new Federal buildings under subpart C of this Part, and in solar heating or solar heating and cooling projects for Federal buildings under subpart D of this Part.

§ 436.11 Definitions.

As used in this subpart—

"Alternative building system" means an energy conservation measure, as defined by § 436.41, including a renewable energy system, for an existing Federal building, or a primarily energy saving building system, including a renewable energy system, for consideration as part of the design for a new Federal building.

"Base Year" means the year in which a life cycle cost analysis is conducted.

"Building" means any structure with a roof and walls designed for storage or human use.

"Building system" means any portion of the structure of the building or of any energy using system in the building.

"Existing Federal building" means a Federal building the construction of which was complete by November 9, 1978, or the design of which cannot feasibly be modified after the effective date of subpart C of this Part.

"Federal agency" means an Executive agency under 5 U.S.C. 105(1970), the United States Postal Service, and each entity specified in 5 U.S.C. 5721(1)(B)–(H) (1970).

"Federal building" means any building, structure, or facility, as defined in § 436.41, which is constructed, renovated or leased or purchased in whole or in part for use by the United States, and which includes a heating system, or cooling system, or both.

"Investment costs" means the initial costs of design, engineering, purchase, and installation exclusive of sunk costs.

"Life Cycle Cost" means the total costs of owning, operating, and maintaining a building over its useful life, including its fuel and energy costs, determined on the basis of a systematic evaluation and comparison of alternative building systems; except that in the case of leased buildings, the life cycle cost shall be calculated over the effective remaining term of the lease.

"New Federal building" means a Federal building for which construction was not completed prior to November 9, 1978, and the design of which can be feasibly modified on the effective date of subpart C of this Part.

Non-recurring costs" means costs that are not uniformly incurred annually over the study period.

"Non-fuel operation and maintenance costs" means material and labor costs for routine upkeep and operation exclusive of energy costs.

"Recurring costs" means costs that are incurred uniformly and annually over the study period.

"Replacement costs" means future costs to replace a building system or any component thereof which wears out.

"Retrofit" means to install an alternative building system in an existing Federal building.

"Salvage value" means the value of any building system removed or replaced during the study period or remaining at the end of the study period, or recovered through resale at the end of the study period.

"Study period" means the time period covered by a life cycle cost analysis.

"Sunk costs" means costs incurred prior to the year in which the life cycle cost analysis occurs.

§ 436.12 Life cycle cost methodology.

The life cycle cost methodology for this Part is a systematic analysis of relevant costs, excluding sunk costs, over a study period, relating initial costs to future costs by the technique of discounting future costs to present values.

§ 436.13 Presuming cost-effectiveness results.

(a) If the investment and other costs for an alternative building system considered for retrofit to an existing Federal building are insignificant, a Federal agency may presume that such a system is life cycle cost effective without further analysis.

(b) A Federal agency may presume that an investment in an alternative building system for retrofit to an existing Federal building is *not* life cycle cost effective if the Federal building is—

(1) occupied under a short-term lease without a renewal option or with a renewal option which is not likely to be exercised;

(2) occupied under a lease which excludes the cost of utilities from rent; or

(3) scheduled to be demolished or retired from service by last day of FY 1985.

§ 436.14 Methodological assumptions.

Except in determining estimated simple payback time, each Federal agency shall assume:

(a) that the annual discount rate is 10 percent, and shall adjust cost data accordingly by applying the appropriate present worth factors from the tables in Appendix A;

(b) that energy prices will rise at rates faster than the rate of increase in the general price level, and shall adjust energy cost data accordingly by applying the appropriate modified present worth factors based on the 10 percent discount rate and adjusted for energy price escalation for the applicable region, sector, fuel type, and study period from tables 1 through 11 of Appendix B;

(c) that the price of energy in the base year is the price for the appropriate region, sector, and fuel type given in Table 1 in Appendix C, or, if higher, the actual price to the Federal agency of energy delivered to the Federal building;

(d) that the appropriate study period—

(1) for evaluating or ranking alternative building system retrofits for an owned existing Federal building, is the lesser of 30 years or the estimated life of the alternative building system or the estimated life of the building;

(2) for determining the Total Life Cycle Costs or Net Savings of mutually exclusive alternatives for a given building system is an equivalent study period which may be:

(i) the estimate useful life of one of the alternatives;

(ii) a common multiple of the useful lives of both alternatives; or

(iii) the lesser of 30 years or the useful life of the building;

(3) for evaluating alternative designs for an owned new Federal building, is the lesser of 30 years or the period of intended use for that building; and

(4) for a leased Federal building, is the effective remaining term of the lease which may include renewal options likely to be exercised.

(e) that the useful life of any building system is the period of service without major renewal or overhaul estimated by the manufacturer or any other reliable source;

(f) that the investment costs are a lump sum occurring in the base year;

(g) that energy costs and non-fuel operation and maintenance begin accruing in the year following the base year; and

(h) that costs in any year occur in a lump sum at the end of the year in which they are incurred.

§ 436.15 Formatting cost data.

In establishing cost data under §§ 436.16 and 436.17 and measuring cost effectiveness by the modes of analysis described by §§ 436.19–436.22, a format for accomplishing the analysis shall be used. Federal agencies are encouraged to use formats such as those set forth in the "Life Cycle Cost Manual for Federal Energy Management and Planning Programs."

§ 436.16 Establishing non-fuel cost data.

(a) The relevant non-fuel cost categories are—

(1) investment costs;

(2) non-fuel operation and maintenance costs;

(3) replacement costs; and

(4) salvage value.

(b) The investment costs are assumed to be a present value under § 436.14(f).

(c) The present value of recurring costs is the sum of the product of the base year value of recurring costs as multiplied by the appropriate uniform present worth factor for the applicable study period from table 2 in Appendix A.

(d) The present value of non-recurring costs under § 436.16(a)(2)–(a)(4) is the sum of the products of the non-recurring costs as mulitplied by appropriate single present worth factors from table 1 of Appendix A for the respective years in which the costs are expected to be incurred.

§ 436.17 Establishng energy cost data.

(a) Each Federal agency shall establish energy costs in the base year by multiplying the total units of energy used in the base year as measured at the boundary of the building by the price per unit of energy in the base year as determined in accordance with § 436.14(c).

(b) The present value of energy costs over the study period shall be calculated by multiplying the energy costs in the base year as established under § 436.17(a) by the appropriate modified uniform present worth factor adjusted for energy price escalation for the applicable region, sector, fuel type, and study period from tables 1 through 11 of Appendix B.

§ 436.18 Measuring cost effectiveness.

(a) In accordance with this section, each Federal agency shall measure cost effectiveness by combining cost data established under §§ 436.16 and 436.17 in the appropriate mode of analysis as described in §§ 436.19–436.22.

(b) Replacement of a building system with an alternative building system by retrofit to an existing Federal building or substitution in the design for a new Federal building shall be deemed cost effective if—

(1) total life cycle costs, as described by § 436.19, are estimated to be lower; or

(2) net savings, as described by § 436.20, are estimated to be positive; or

(3) the savings-to-investment ratio, as described by § 436.21, is estimated to be greater than one.

(c) As a rough, approximate measure, each Federal agency may determine estimated simple payback time under § 436.22 which indicates whether a retrofit is likely to be cost effective under § 436.18(b). An alternative system is likely to be cost-effective if estimated payback time is significantly less than the useful life of that system and of the Federal building in which it is installed.

(d) Mutually exclusive alternatives for a given building system considered in determining such matters as the optimal size of a solar energy system, the optimal thickness of insulation, or the best choice of double- or triple-glazing for windows, shall be compared evaluated on the basis of total life cycle costs or net savings over equivalent study periods. The alternative which is estimated to result in the lowest total life cycle costs or the highest net savings of the alternative considered, shall be deemed the most cost effective because it tends to minimize the life cycle cost of the Federal building.

(e) Cost effective alternative building systems shall be ranked in descending order of their savings-to-investment ratios.

(f) Alternative building designs for new Federal buildings shall be evaluated on the basis of total life cycle costs. The alternative design which results in the lowest total life cycle costs for a given new building shall be deemed the most cost effective.

§ 436.19 Total life cycle costs.

Total life-cycle costs are the sum of the present values of—

(a) Investment costs less salvage values at the end of the study period;

(b) Non-fuel operation and maintenance costs;

(c) Replacement costs less salvage costs of replaced building systems; and

(d) Energy costs.

§ 436.20 Net savings.

Net savings is the difference in the present values of savings and costs of an alternative building system.

§ 436.21 Savings-to-investment ratio.

The savings-to-investment ratio is the ratio of present value saving to present value costs over the study period for an alternative building system as compared to an existing building system. The numerator of the ratio is the net difference in present value energy and non-fuel operation and maintenance costs between the alternative and the existing building system. The denominator of the ratio is the net difference between the alternative and existing building system in present value investment and replacement costs less salvage value.

§ 436.22 Estimated simple payback time.

The estimated simple payback time is the number of years required for the cumulative value of energy cost savings less future non-fuel costs to equal the investment costs of the building system, without consideration of future fuel price increases or discount rates.

§ 436.23 Sensitivity analysis.

If there is uncertainty regarding particular items of cost data, a sensitivity analysis may be performed by varying the analysis under § 436.19–§ 436.21 for those items to determine whether the variation has a significant impact on the result of an analysis.

Appendix A to Subpart A of Part 436

Table A–1: *Single present worth factors for discounting future non-recurring cost to present value (based upon a 10 percent discount rate)*

Study period	Factor
1	0.9091
2	0.8264
3	0.7513
4	0.6830
5	0.6209
6	0.5645
7	0.5132
8	0.4665
9	0.4241
10	0.3855
11	0.3505
12	0.3187
13	0.2897
14	0.2633
15	0.2394
16	0.2176
17	0.1979
18	0.1796
19	0.1635
20	0.1486
21	0.1351
22	0.1229
23	0.1117
24	0.1015
25	0.0923
26	0.0839
27	0.0763
28	0.0693
29	0.0630
30	0.0573

Table A–2: *Uniform present worth factors for discounting future non-fuel recurring cost to present value (based on 10 percent discount rate)*

Study period	Factor
1	0.9091
2	1.7355
3	2.4868
4	3.1698
5	3.7907
6	4.3552
7	4.8684
8	5.3449
9	5.7590
10	6.1445
11	6.4930
12	6.8137
13	7.1034
14	7.3667
15	7.6061
16	7.8238
17	8.0216
18	8.2014
19	8.3649
20	8.5135
21	8.6486
22	8.7715
23	8.8832
24	8.9847
25	9.0770
26	9.1610
27	9.2370
28	9.3070
29	9.3700
30	9.4270

Appendix B to Subpart A of Part 436

Table B–1—Uniform Present Worth Factor for DOE Region I, Maine, New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural Gas	Distillate	Liquid Gas	Electricity	Natural Gas	Distillate	Residual	Electricity	Natural Gas	Distillate	Residual	Liquid Gas	Coal
1	0.922	0.933	0.945	0.946	0.921	0.935	0.948	0.965	0.929	0.950	0.937	0.956	0.947	0.966
2	1.772	1.804	1.829	1.840	1.770	1.806	1.849	1.895	1.791	1.853	1.816	1.869	1.845	1.963
3	2.555	2.616	2.684	2.685	2.551	2.625	2.704	2.782	2.592	2.710	2.640	2.742	2.695	2.926
4	3.277	3.374	3.483	3.485	3.272	3.388	3.515	3.658	3.336	3.524	3.412	3.576	3.501	3.877
5	3.943	4.082	4.238	4.241	3.935	4.101	4.264	4.493	4.026	4.288	4.135	4.374	4.264	4.816
6	4.547	4.736	4.937	4.940	4.537	4.763	4.997	5.268	4.653	5.016	4.806	5.114	4.970	5.685
7	5.096	5.342	5.584	5.586	5.084	5.377	5.658	5.987	5.223	5.683	5.428	5.801	5.623	6.468
8	5.595	5.903	6.184	6.183	5.581	5.947	6.271	6.655	5.740	6.302	6.004	6.436	6.226	7.231
9	6.047	6.423	6.739	6.735	6.032	6.476	6.839	7.275	6.209	6.874	6.538	7.030	6.785	7.918
10	6.459	6.909	7.253	7.245	6.442	6.967	7.368	7.851	6.635	7.405	7.033	7.579	7.302	8.554
11	6.840	7.348	7.744	7.737	6.822	7.422	7.866	8.409	7.033	7.900	7.507	8.105	7.801	9.162
12	7.194	7.760	8.212	8.211	7.175	7.845	8.350	8.933	7.404	8.411	7.960	8.609	8.284	9.748
13	7.522	8.142	8.659	8.668	7.502	8.238	8.811	9.440	7.749	8.881	8.393	9.093	8.750	10.309
14	7.827	8.495	9.086	9.109	7.806	8.602	9.252	9.927	8.072	9.332	8.808	9.556	9.200	10.837
15	8.109	8.823	9.493	9.534	8.088	8.941	9.673	10.394	8.373	9.765	9.205	10.000	9.635	11.348
16	8.371	9.126	9.882	9.944	8.350	9.255	10.076	10.842	8.654	10.180	9.584	10.425	10.058	11.838
17	8.614	9.406	10.253	10.339	8.593	9.546	10.462	11.272	8.915	10.577	9.947	10.833	10.462	12.307
18	8.839	9.666	10.607	10.720	8.818	9.817	10.831	11.684	9.160	10.959	10.294	11.224	10.854	12.756
19	9.048	9.907	10.945	11.087	9.027	10.068	11.184	12.078	9.387	11.325	10.626	11.598	11.233	13.186
20	9.242	10.130	11.267	11.442	9.222	10.301	11.521	12.457	9.600	11.676	10.943	11.957	11.600	13.598
21	9.422	10.336	11.575	11.783	9.402	10.518	11.844	12.821	9.798	12.013	11.247	12.301	11.954	13.992
22	9.588	10.527	11.869	12.112	9.569	10.719	12.153	13.169	9.983	12.336	11.537	12.630	12.296	14.370
23	9.743	10.704	12.150	12.430	9.724	10.905	12.449	13.503	10.155	12.646	11.815	12.946	12.626	14.731
24	9.886	10.868	12.417	12.736	9.869	11.076	12.731	13.823	10.316	12.943	12.081	13.249	12.945	15.078
25	10.020	11.019	12.673	13.031	10.002	11.239	13.002	14.131	10.466	13.228	12.335	13.539	13.254	15.409
26	10.143	11.160	12.917	13.316	10.126	11.386	13.260	14.425	10.606	13.501	12.579	13.817	13.552	15.727
27	10.258	11.290	13.149	13.590	10.242	11.527	13.507	14.708	10.736	13.760	12.811	14.084	13.840	16.030
28	10.364	11.410	13.371	13.854	10.348	11.655	13.744	14.979	10.858	14.014	13.034	14.339	14.118	16.322
29	10.462	11.522	13.584	14.109	10.448	11.775	13.970	15.239	10.971	14.255	13.247	14.584	14.387	16.600
30	10.554	11.625	13.786	14.355	10.540	11.886	14.187	15.488	11.077	14.486	13.450	14.818	14.646	16.867

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Table B–2—Uniform Present Worth Factor for DOE Region II, New York, New Jersey, Puerto Rico, Virgin Islands

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural Gas	Distillate	Liquid Gas	Electricity	Natural Gas	Distillate	Residual	Electricity	Natural Gas	Distillate	Residual	Liquid Gas	Coal
1	0.908	0.935	0.950	0.950	0.910	0.932	0.952	0.973	0.932	0.964	0.940	0.964	0.950	1.017
2	1.781	1.810	1.852	1.853	1.798	1.801	1.857	1.921	1.773	1.852	1.823	1.890	1.858	2.052
3	2.479	2.629	2.708	2.710	2.464	2.610	2.719	2.844	2.557	2.805	2.654	2.788	2.710	3.105
4	3.156	3.394	3.522	3.524	3.181	3.365	3.536	3.741	3.280	3.643	3.434	3.651	3.524	4.178
5	3.774	4.110	4.295	4.296	3.807	4.068	4.318	4.618	3.947	4.765	4.168	4.480	4.298	5.265
6	4.334	4.785	5.010	5.013	4.376	4.734	5.041	5.427	4.554	5.622	4.847	5.254	5.014	6.274
7	4.844	5.421	5.672	5.674	4.894	5.365	5.711	6.170	5.106	6.417	5.477	5.970	5.678	7.207
8	5.308	6.020	6.285	6.284	5.365	5.963	6.332	6.878	5.609	7.166	6.060	6.633	6.288	8.072
9	5.730	6.584	6.852	6.848	5.793	6.530	6.907	7.526	6.067	7.842	6.600	7.248	6.854	8.872
10	6.113	7.117	7.378	7.369	6.185	7.067	7.440	8.127	6.483	8.479	7.100	7.819	7.377	9.615
11	6.466	7.614	7.870	7.872	6.543	7.570	7.950	8.700	6.871	9.091	7.579	8.365	7.880	10.325
12	6.795	8.078	8.356	8.356	6.875	8.042	8.437	9.255	7.233	9.677	8.037	8.888	8.371	11.006
13	7.098	8.511	8.814	8.822	7.182	8.484	8.904	9.784	7.570	10.240	8.476	9.388	8.843	11.664
14	7.377	8.915	9.250	9.271	7.466	8.898	9.350	10.290	7.884	10.780	8.895	9.867	9.299	12.294
15	7.635	9.294	9.666	9.704	7.728	9.286	9.777	10.775	8.177	11.296	9.296	10.325	9.739	12.899
16	7.873	9.648	10.064	10.122	7.970	9.650	10.185	11.240	8.450	11.796	9.680	10.764	10.164	13.479
17	8.093	9.978	10.443	10.524	8.193	9.991	10.576	11.686	8.705	12.273	10.047	11.183	10.574	14.037
18	8.297	10.286	10.804	10.911	8.400	10.310	10.949	12.112	8.942	12.731	10.398	11.585	10.971	14.572
19	8.485	10.574	11.150	11.285	8.590	10.609	11.306	12.521	9.163	13.170	10.734	11.969	11.354	15.086
20	8.658	10.842	11.479	11.645	8.766	10.890	11.648	12.912	9.369	13.592	11.056	12.337	11.724	15.580
21	8.816	11.093	11.794	11.991	8.929	11.153	11.975	13.288	9.561	13.996	11.363	12.689	12.082	16.054
22	8.960	11.328	12.094	12.325	9.079	11.400	12.288	13.647	9.741	14.384	11.656	13.026	12.427	16.509
23	9.103	11.547	12.381	12.647	9.217	11.631	12.587	13.991	9.907	14.757	11.930	13.348	12.760	16.945
24	9.229	11.752	12.654	12.958	9.345	11.847	12.873	14.321	10.063	15.114	12.209	13.656	13.083	17.365
25	9.346	11.943	12.915	13.257	9.464	12.050	13.147	14.637	10.206	15.457	12.466	13.952	13.394	17.768
26	9.453	12.121	13.164	13.545	9.573	12.240	13.409	14.939	10.343	15.786	12.713	14.234	13.694	18.155
27	9.553	12.288	13.402	13.823	9.674	12.418	13.659	15.229	10.466	16.102	12.949	14.504	13.984	18.526
28	9.645	12.443	13.629	14.090	9.767	12.585	13.899	15.507	10.587	16.405	13.174	14.763	14.263	18.883
29	9.729	12.588	13.846	14.348	9.853	12.742	14.128	15.773	10.696	16.695	13.390	15.011	14.534	19.225
30	9.808	12.725	14.053	14.596	9.932	12.888	14.347	16.028	10.798	16.974	13.597	15.248	14.797	19.554

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Table B-3—Uniform Present Worth Factor for DOE Region III, Pennsylvania, Maryland, West Virginia, Virginia, District of Columbia, Delaware

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural gas	Distillate	Liquid gas	Electricity	Natural gas	Distillate	Residual	Electricity	Natural gas	Distillate	Residual	Liquid gas	Coal
1	0.920	0.946	0.955	0.960	0.915	0.937	0.953	0.983	0.933	0.965	0.944	0.969	0.955	1.036
2	1.765	1.841	1.867	1.881	1.754	1.816	1.862	1.948	1.802	1.896	1.836	1.909	[illegible]	2.109
3	2.543	2.688	2.739	2.766	2.521	2.640	2.728	2.896	2.613	2.794	2.678	2.820	2.740	3.220
4	3.258	3.488	3.571	3.614	3.223	3.412	3.553	3.828	3.369	3.661	3.474	3.703	3.572	4.371
5	3.915	4.246	4.365	4.429	3.866	4.135	4.340	4.744	4.075	4.498	4.225	4.559	4.368	5.564
6	4.517	4.955	5.100	5.181	4.455	4.815	5.069	5.593	4.722	5.310	4.920	5.353	5.103	6.660
7	5.067	5.619	5.780	5.875	4.994	5.454	5.744	6.360	5.315	6.099	5.565	6.089	5.782	7.693
8	5.571	6.239	6.409	6.516	5.487	6.054	[illegible]	7.109	5.859	6.865	6.162	6.771	6.410	8.643
9	6.033	6.820	6.990	7.108	5.939	6.617	6.947	7.786	6.359	7.609	6.714	7.404	6.991	9.523
10	6.455	7.364	7.528	7.655	6.352	7.146	7.483	8.412	6.817	8.332	7.226	7.991	7.527	10.339
11	6.847	7.871	8.040	8.180	6.738	7.641	7.996	9.011	7.246	9.025	7.715	8.552	8.044	11.124
12	7.213	8.342	8.529	8.684	7.097	8.102	8.486	9.583	7.648	9.691	8.183	9.089	8.542	11.881
13	7.553	8.781	8.995	9.169	7.431	8.533	8.955	10.129	8.026	10.329	8.630	9.601	9.023	12.609
14	7.870	9.190	9.439	9.635	7.743	8.936	9.404	10.650	8.379	10.942	9.056	10.091	9.486	13.311
15	8.165	9.571	9.862	10.083	8.033	9.312	9.833	11.148	8.711	11.530	9.464	10.559	9.932	13.986
16	8.439	9.926	10.266	10.513	8.303	9.663	10.243	11.624	9.022	12.094	9.854	11.006	10.362	14.636
17	8.694	10.256	10.651	10.927	8.555	9.990	10.635	12.078	9.313	12.635	10.227	11.434	10.777	15.262
18	8.931	10.564	11.018	11.324	8.790	10.296	11.011	12.512	9.586	13.154	10.583	11.843	11.176	15.865
19	9.152	10.850	11.368	11.706	9.009	10.582	11.370	12.926	9.843	13.653	10.923	12.233	11.562	16.446
20	9.358	11.117	11.701	12.072	9.213	10.849	11.713	13.321	10.083	14.131	11.248	12.607	11.933	17.005
21	9.550	11.366	12.019	12.425	9.402	11.098	12.042	13.699	10.308	14.590	11.559	12.963	12.291	17.543
22	9.728	11.597	12.322	12.763	9.579	11.331	12.356	14.060	10.519	15.030	11.856	13.304	12.636	18.062
23	9.893	11.813	12.611	13.089	9.744	11.548	12.656	14.404	10.716	15.452	12.140	13.630	12.968	18.561
24	10.048	12.013	12.887	13.402	9.897	11.751	12.944	14.733	10.902	15.858	12.411	13.942	13.289	19.042
25	10.191	12.200	13.149	13.702	10.040	11.941	13.219	15.047	11.076	16.247	12.670	14.239	13.598	19.504
26	10.325	12.374	13.400	13.991	10.174	12.118	13.481	15.348	11.239	16.620	12.918	14.524	13.896	19.950
27	10.449	12.536	13.639	14.268	10.298	12.283	13.733	15.634	11.391	16.978	13.155	14.796	14.183	20.379
28	10.565	12.687	13.866	14.535	10.413	12.437	13.973	15.908	11.535	17.322	13.381	15.055	14.460	20.792
29	10.673	12.828	14.083	14.791	10.521	12.581	14.203	16.169	11.669	17.651	13.597	15.304	14.727	21.190
30	10.773	12.959	14.290	15.037	10.621	12.716	14.423	16.419	11.795	17.968	13.803	15.541	14.984	21.573

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors

Table B-4—Uniform Present Worth Factor for DOE Region IV, Kentucky, Tennessee, North Carolina, South Carolina, Mississippi, Alabama, Georgia, Florida, Canal Zone

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural Gas	Distillate	Liquid Gas	Electricity	Natural Gas	Distillate	Residual	Electricity	Natural Gas	Distillate	Residual	Liquid Gas	Coal
1	0.925	0.954	0.961	0.969	0.926	0.949	0.958	0.983	0.944	0.993	0.948	0.966	0.968	1.033
2	1.781	1.863	1.883	1.908	1.784	1.850	1.875	1.951	1.836	1.979	1.845	1.900	1.906	2.100
3	2.573	2.731	2.770	2.818	2.579	2.705	2.754	2.902	2.678	2.959	2.696	2.802	2.813	3.203
4	3.305	3.558	3.622	3.700	3.315	3.517	3.596	3.837	3.473	3.931	3.502	3.673	3.692	4.342
5	3.982	4.347	4.440	4.555	3.997	4.287	4.402	4.757	4.224	4.897	4.266	4.515	4.542	5.519
6	4.605	5.078	5.196	5.344	4.628	5.004	5.149	5.612	4.915	5.847	4.974	5.297	5.329	6.601
7	5.176	5.756	5.896	6.070	5.196	5.669	5.841	6.407	5.552	6.779	5.629	6.024	6.055	7.596
8	5.700	6.383	6.543	6.745	5.725	6.288	6.482	7.145	6.139	7.696	6.236	6.699	6.726	8.512
9	6.182	6.964	7.142	7.366	6.210	6.863	7.075	7.831	6.680	8.597	6.798	7.326	7.347	9.353
10	6.624	7.503	7.696	7.939	6.655	7.398	7.626	8.468	7.179	9.482	7.318	7.909	7.920	10.127
11	7.036	8.009	8.223	8.490	7.069	7.903	8.152	9.080	7.647	10.338	7.816	8.468	8.472	10.872
12	7.421	8.484	8.726	9.019	7.456	8.379	8.655	9.666	8.086	11.165	8.291	9.005	9.005	11.589
13	7.780	8.930	9.204	9.526	7.816	8.829	9.136	10.229	8.499	11.965	8.746	9.520	9.517	12.279
14	8.115	9.349	9.660	10.016	8.151	9.253	9.595	10.769	8.888	12.738	9.180	10.015	10.012	12.944
15	8.427	9.743	10.094	10.485	8.464	9.654	10.035	11.286	9.252	13.485	9.595	10.489	10.488	13.583
16	8.716	10.113	10.507	10.936	8.756	10.032	10.455	11.783	9.595	14.207	9.992	10.945	10.947	14.198
17	8.990	10.460	10.901	11.369	9.028	10.389	10.657	12.259	9.916	14.906	10.371	11.383	11.389	14.790
18	9.244	10.787	11.276	11.785	9.281	10.726	11.241	12.716	10.219	15.581	10.733	11.803	11.814	15.360
19	9.480	11.093	11.633	12.185	9.517	11.044	11.609	13.154	10.503	16.233	11.080	12.206	12.225	15.909
20	9.701	11.381	11.973	12.570	9.738	11.344	11.960	13.574	10.769	16.863	11.411	12.593	12.620	16.437
21	9.906	11.651	12.297	12.939	9.943	11.628	12.295	13.977	11.020	17.473	11.727	12.964	13.001	16.945
22	10.098	11.905	12.606	13.294	10.134	11.895	12.616	14.364	11.256	18.062	12.029	13.321	13.368	17.434
23	10.277	12.144	12.900	13.635	10.312	12.147	12.923	14.735	11.477	18.632	12.318	13.663	13.722	17.904
24	10.444	12.368	13.180	13.962	10.478	12.386	13.217	15.090	11.685	19.182	12.595	13.992	14.063	18.357
25	10.600	12.578	13.446	14.277	10.633	12.611	13.497	15.431	11.880	19.714	12.858	14.307	14.392	18.793
26	10.745	12.776	13.700	14.579	10.778	12.823	13.766	15.759	12.063	20.229	13.111	14.610	14.708	19.213
27	10.881	12.962	13.942	14.870	10.912	13.023	14.022	16.073	12.236	20.726	13.352	14.900	15.013	19.617
28	11.007	13.136	14.173	15.149	11.036	13.213	14.267	16.374	12.397	21.207	13.582	15.179	15.307	20.006
29	11.125	13.300	14.392	15.417	11.150	13.391	14.502	16.663	12.550	21.671	13.802	15.447	15.590	20.380
30	11.235	13.454	14.601	15.675	11.264	13.560	14.726	16.940	12.692	22.121	14.013	15.704	15.863	20.740

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors

Table B–5—Uniform Present Worth Factor for DOE Region V, Minnesota, Wisconsin, Michigan, Illinois, Indiana, Ohio

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural gas	Distillate	Liquid gas	Electricity	Natural gas	Distillate	Residual	Electricity	Natural gas	Distillate	Residual	Liquid gas	Coal
1	0.928	0.958	0.949	0.960	0.925	0.956	0.951	0.957	0.940	0.983	0.939	0.946	0.961	1.009
2	1.775	1.877	1.848	1.880	1.780	1.876	1.854	1.872	1.824	1.950	1.820	1.840	1.885	2.068
3	2.562	2.757	2.702	2.764	2.572	2.758	2.713	2.747	2.655	2.900	2.648	2.686	2.773	3.176
4	3.288	3.600	3.511	3.611	3.308	3.598	3.530	3.585	3.496	3.835	3.424	3.486	3.626	4.298
5	3.958	4.408	4.279	4.425	3.980	4.405	4.307	4.386	4.170	4.753	4.154	4.242	4.446	5.454
6	4.573	5.162	4.992	5.178	4.601	5.161	5.027	5.132	4.845	5.637	4.831	4.948	5.206	6.618
7	5.136	5.866	5.653	5.877	5.170	5.868	5.697	5.826	5.467	6.488	5.460	5.602	5.911	7.486
8	5.653	6.523	6.266	6.525	5.692	6.530	6.319	6.472	6.038	7.307	6.044	6.211	6.564	8.379
9	6.127	7.137	6.836	7.122	6.171	7.150	6.896	7.074	6.564	8.095	6.586	6.778	7.169	9.189
10	6.562	7.710	7.364	7.677	6.609	7.730	7.432	7.634	7.047	8.853	7.090	7.306	7.731	9.952
11	6.967	8.248	7.855	8.212	7.019	8.277	7.946	8.171	7.502	9.582	7.573	7.813	8.273	10.680
12	7.346	8.753	8.313	8.728	7.402	8.792	8.439	8.686	7.931	10.282	8.036	8.298	8.797	11.383
13	7.700	9.229	8.745	9.226	7.760	9.278	8.912	9.180	8.335	10.954	8.479	8.764	9.303	12.063
14	8.030	9.675	9.150	9.706	8.095	9.736	9.365	9.653	8.716	11.599	8.904	9.210	9.792	12.720
15	8.338	10.094	9.534	10.168	8.405	10.168	9.800	10.106	9.074	12.219	9.312	9.639	10.264	13.355
16	8.626	10.489	10.000	10.614	8.696	10.575	10.216	10.541	9.412	12.815	9.703	10.050	10.721	13.969
17	8.895	10.859	10.478	11.044	8.968	10.959	10.616	10.958	9.730	13.387	10.077	10.444	11.162	14.562
18	9.146	11.207	10.850	11.459	9.222	11.321	10.999	11.358	10.029	13.937	10.436	10.822	11.588	15.135
19	9.380	11.534	11.206	11.859	9.460	11.662	11.366	11.742	10.312	14.464	10.780	11.184	11.999	15.690
20	9.598	11.841	11.547	12.245	9.681	11.983	11.718	12.109	10.577	14.971	11.110	11.532	12.397	16.225
21	9.803	12.130	11.873	12.617	9.888	12.287	12.055	12.461	10.826	15.459	11.426	11.865	12.781	16.743
22	9.993	12.401	12.185	12.975	10.081	12.572	12.379	12.799	11.063	15.926	11.729	12.185	13.152	17.244
23	10.171	12.656	12.484	13.321	10.262	12.842	12.690	13.123	11.285	16.376	12.020	12.492	13.510	17.727
24	10.338	12.896	12.770	13.655	10.430	13.098	12.987	13.433	11.495	16.807	12.298	12.786	13.857	18.195
25	10.493	13.121	13.043	13.976	10.587	13.335	13.272	13.731	11.692	17.222	12.565	13.068	14.191	18.647
26	10.638	13.332	13.305	14.286	10.734	13.561	13.546	14.016	11.877	17.620	12.821	13.338	14.514	19.083
27	10.773	13.531	13.556	14.585	10.872	13.774	13.808	14.290	12.052	18.003	13.066	13.598	14.827	19.506
28	10.899	13.718	13.796	14.874	11.000	13.974	14.060	14.552	12.217	18.370	13.301	13.847	15.128	19.914
29	11.017	13.893	14.025	15.152	11.120	14.164	14.301	14.804	12.372	18.723	13.526	14.085	15.420	20.308
30	11.127	14.058	14.245	15.420	11.231	14.342	14.532	15.045	12.518	19.062	13.742	14.314	15.701	20.689

These uniform present worth worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Table B–6—Uniform Present Worth Factor for DOE Region VI, Texas, New Mexico, Oklahoma, Arkansas, Louisiana

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural Gas	Distillate	Liquid Gas	Electricity	Natural Gas	Distillate	Residual	Electricity	Natural Gas	Distillate	Residual	Liquid Gas	Coal
1	0.952	0.967	0.960	0.968	0.956	0.964	0.964	0.968	0.981	1.019	0.951	0.977	0.967	1.002
2	1.858	1.903	1.891	1.904	1.870	1.953	1.982	1.965	1.942	2.057	1.855	1.932	1.903	2.006
3	2.720	2.808	2.786	2.809	2.745	2.906	2.787	2.931	2.885	3.114	2.715	2.868	2.808	3.012
4	3.540	3.684	3.647	3.686	3.581	3.843	3.649	3.806	3.809	4.191	3.533	3.778	3.684	4.020
5	4.321	4.531	4.477	4.534	4.380	4.766	4.480	4.820	4.716	5.268	4.311	4.689	4.531	5.030
6	5.040	5.329	5.245	5.319	5.117	5.640	5.250	5.706	5.554	6.331	5.032	5.497	5.317	5.955
7	5.703	6.080	5.956	6.047	5.797	6.467	5.964	6.520	6.330	7.322	5.701	6.266	6.044	6.802
8	6.314	6.787	6.615	6.721	6.424	7.251	6.626	7.276	7.048	8.268	6.320	6.981	6.719	7.579
9	6.877	7.453	7.225	7.345	7.003	7.992	7.239	7.978	7.711	9.160	6.895	7.644	7.345	8.289
10	7.395	8.080	7.790	7.923	7.536	8.694	7.808	8.630	8.329	10.011	7.427	8.260	7.925	8.940
11	7.876	8.668	8.330	8.480	8.032	9.358	8.352	9.255	8.899	10.815	7.937	8.851	8.485	9.570
12	8.323	9.220	8.845	9.018	8.493	9.979	8.873	9.855	9.434	11.576	8.425	9.419	9.026	10.178
13	8.738	9.739	9.337	9.536	8.922	10.566	9.372	10.431	9.933	12.295	8.892	9.965	9.548	10.765
14	9.123	10.226	9.807	10.036	9.320	11.122	9.849	10.983	10.399	12.975	9.340	10.485	10.053	11.333
15	9.480	10.683	10.256	10.517	9.690	11.645	10.306	11.513	10.834	13.618	9.768	10.986	10.541	11.882
16	9.812	11.112	10.684	10.982	10.033	12.137	10.743	12.021	11.240	14.226	10.178	11.467	11.012	12.413
17	10.120	11.515	11.094	11.430	10.353	12.602	11.161	12.509	11.619	14.801	10.570	11.928	11.467	12.925
18	10.406	11.894	11.485	11.862	10.650	13.040	11.562	12.977	11.973	15.344	10.946	12.371	11.906	13.421
19	10.671	12.249	11.858	12.278	10.926	13.453	11.945	13.425	12.303	15.858	11.306	12.795	12.330	13.900
20	10.917	12.582	12.214	12.680	11.182	13.842	12.312	13.856	12.611	16.343	11.650	13.202	12.740	14.363
21	11.146	12.895	12.555	13.067	11.421	14.209	12.664	14.269	12.899	16.802	11.980	13.593	13.136	14.810
22	11.358	13.189	12.880	13.440	11.642	14.555	13.000	14.665	13.167	17.237	12.296	13.968	13.519	15.242
23	11.555	13.465	13.190	13.800	11.848	14.881	13.322	15.046	13.418	17.647	12.598	14.328	13.888	15.660
24	11.738	13.724	13.487	14.147	12.039	15.188	13.630	15.410	13.652	18.035	12.887	14.673	14.245	16.064
25	11.908	13.967	13.770	14.481	12.217	15.478	13.925	15.760	13.870	18.402	13.164	15.005	14.590	16.454
26	12.065	14.195	14.041	14.804	12.383	15.751	14.207	16.096	14.074	18.749	13.429	15.322	14.923	16.831
27	12.212	14.410	14.299	15.115	12.536	16.009	14.477	16.418	14.264	19.077	13.683	15.627	15.244	17.196
28	12.347	14.611	14.545	15.415	12.679	16.252	14.736	16.727	14.441	19.387	13.926	15.920	15.555	17.548
29	12.474	14.800	14.781	15.704	12.812	16.480	14.984	17.023	14.607	19.680	14.159	16.200	15.855	17.888
30	12.591	14.977	15.006	15.982	12.935	16.696	15.220	17.308	14.762	19.957	14.382	16.470	16.145	18.217

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Table B-7—Uniform Present Worth Factor for DOE Region VII, Kansas, Missouri, Iowa, Nebraska

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural gas	Distillate	Liquid gas	Electricity	Natural gas	Distillate	Residual	Electricity	Natural gas	Distillate	Residual	Liquid gas	Coal
1	0.920	[illegible]	0.949	0.959	0.925	0.973	0.951	0.980	0.934	1.012	0.939	0.964	0.961	1.013
2	1.765	1.892	1.850	1.879	1.780	1.920	1.856	1.941	1.805	2.036	1.821	1.893	1.884	2.041
3	2.543	[illegible]	2.705	2.762	2.570	2.841	2.717	2.882	2.619	3.073	2.649	2.789	2.771	3.081
4	3.258	3.648	3.517	3.608	3.301	3.737	3.535	3.805	3.379	4.121	3.426	3.653	3.623	4.136
5	3.915	4.478	4.287	4.420	3.977	4.609	4.314	4.709	4.088	5.183	4.156	4.485	4.442	5.205
6	4.512	5.265	5.002	5.173	4.590	5.441	5.036	5.549	4.732	6.233	4.833	5.258	5.202	6.185
7	5.053	6.012	5.664	5.871	5.146	6.234	5.706	6.330	5.315	7.272	5.462	5.976	5.907	7.083
8	5.545	6.721	6.277	6.518	5.651	6.989	[illegible]	7.055	5.845	8.301	6.045	6.643	6.560	7.907
9	5.991	7.393	6.846	7.118	6.109	7.710	6.905	7.728	6.325	9.318	6.585	7.263	7.167	8.661
10	6.395	8.031	7.374	7.674	6.525	8.397	7.440	8.354	6.760	10.325	7.087	7.838	7.730	9.353
11	6.770	8.634	7.879	8.212	6.910	9.050	7.953	8.954	7.166	11.292	7.568	8.390	8.275	10.024
12	7.117	9.205	8.362	8.732	7.267	9.670	8.445	9.529	7.544	12.222	8.030	8.920	8.802	10.675
13	7.438	9.745	8.825	9.235	7.597	10.259	8.917	10.081	7.895	13.116	8.473	9.428	9.313	11.306
14	7.736	10.255	9.268	9.721	7.904	10.819	9.369	10.610	8.223	13.975	8.898	9.916	9.808	11.919
15	8.011	10.738	9.692	10.192	8.188	11.350	9.803	11.117	8.529	14.800	9.306	10.384	10.287	12.514
16	[illegible]	11.195	10.098	10.646	8.451	11.855	10.220	11.603	8.813	15.593	9.697	10.833	10.751	13.091
17	8.502	11.627	10.487	11.086	8.695	12.335	10.619	12.069	9.078	16.356	10.072	11.264	11.201	13.650
18	8.720	12.036	10.859	11.511	8.922	12.790	11.002	12.516	9.325	17.089	10.432	11.678	11.636	14.194
19	8.923	12.423	11.215	11.922	9.131	13.223	11.369	12.945	9.554	17.793	10.777	12.075	12.057	14.721
20	9.110	12.788	11.557	12.319	9.326	13.634	11.721	13.356	9.768	18.470	11.109	12.456	12.465	15.232
21	9.283	13.134	11.883	12.703	9.506	14.024	12.058	13.750	[illegible]	19.120	11.427	12.821	12.860	15.728
22	9.444	13.461	12.196	13.075	9.673	14.395	12.382	14.128	10.154	19.746	11.732	13.172	13.243	16.210
23	9.592	13.771	12.495	13.434	9.827	14.747	12.693	14.490	10.327	20.347	12.024	13.509	13.613	16.677
24	9.730	14.064	12.782	13.781	9.971	15.082	12.990	14.837	10.488	20.924	12.305	13.832	13.972	17.130
25	9.857	14.341	13.056	14.117	10.104	15.400	13.276	15.170	10.638	21.479	12.574	14.142	14.320	17.570
26	9.975	14.603	13.319	14.442	10.227	15.702	13.550	15.490	10.778	22.013	12.832	14.440	14.656	17.996
27	10.085	14.851	13.570	14.756	10.341	15.989	13.812	15.796	10.908	22.525	13.080	14.725	14.982	18.410
28	10.186	15.085	13.811	15.060	10.447	16.261	14.064	16.089	11.029	23.018	13.318	14.999	15.297	18.812
29	10.279	15.307	14.041	15.353	10.545	16.520	14.306	16.371	11.142	23.492	13.546	15.262	15.603	19.202
30	10.366	15.516	14.262	15.637	10.636	16.766	14.538	16.641	11.247	23.947	13.765	15.514	15.899	19.580

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors

Table B-8—Uniform Present Worth Factor for DOE Region VIII, Montana, North Dakota, South Dakota, Wyoming, Utah, Colorado

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural Gas	Distillate	Liquid Gas	Electricity	Natural Gas	Distillate	Residual	Electricity	Natural Gas	Distillate	Residual	Liquid Gas	Coal
1	0.932	0.996	0.952	0.956	0.939	1.006	0.954	0.970	0.961	1.022	0.944	0.960	0.958	1.018
2	1.801	1.989	1.857	1.869	1.821	2.018	1.865	1.910	1.885	2.065	1.835	1.883	1.876	2.054
3	2.611	2.978	2.719	2.742	2.649	3.036	2.735	2.821	2.773	3.132	2.676	2.769	2.755	3.108
4	3.366	3.963	3.538	3.576	3.427	4.059	3.565	3.705	3.627	4.221	3.470	3.620	3.598	4.181
5	4.070	4.944	4.318	4.373	4.157	5.089	4.357	4.561	4.447	5.334	4.220	4.437	4.405	5.274
6	4.704	5.861	5.042	5.111	4.814	6.053	5.093	5.360	5.181	6.379	4.916	5.199	5.153	6.272
7	5.275	6.718	5.713	5.794	5.404	6.954	5.776	6.104	5.838	7.360	5.563	5.909	5.847	7.183
8	5.788	7.519	6.335	6.427	5.935	7.798	6.410	6.797	6.426	8.282	6.163	6.571	6.489	8.016
9	6.251	8.267	6.912	7.013	6.412	8.587	7.000	7.443	6.952	9.147	6.720	7.188	7.084	8.777
10	6.667	[illegible]	7.447	7.556	6.841	9.325	7.547	8.044	7.422	9.960	7.237	7.763	7.636	9.472
11	7.054	9.628	7.959	8.076	7.241	10.025	8.071	8.622	7.865	10.735	7.733	8.315	8.168	10.161
12	7.413	10.254	8.448	8.582	7.613	10.690	8.574	9.176	8.282	11.474	8.208	8.845	8.682	10.843
13	7.747	10.846	8.916	9.067	7.960	11.320	9.055	9.708	8.673	12.180	8.662	9.354	9.178	11.520
14	8.057	11.407	9.364	9.534	8.283	11.919	9.516	10.218	9.042	12.853	9.098	9.842	9.657	12.191
15	8.345	11.937	9.792	9.983	8.583	12.487	9.958	10.708	9.388	13.495	9.516	10.311	10.119	12.855
16	8.612	12.439	10.201	10.417	8.863	13.025	10.381	11.177	9.714	14.107	9.914	10.762	10.565	13.514
17	[illegible]	12.915	10.593	10.834	9.124	13.537	10.787	11.628	10.021	14.691	10.296	11.194	10.996	14.167
18	9.091	13.364	10.967	11.236	9.366	14.022	11.175	12.061	10.309	15.249	10.663	11.609	11.412	14.814
19	9.305	13.790	11.325	11.623	9.593	14.462	11.548	12.476	10.581	15.781	11.013	12.008	11.813	15.455
20	9.503	14.193	11.668	11.996	9.803	14.919	11.904	12.874	10.836	16.288	11.349	12.390	12.200	16.090
21	9.668	14.574	11.995	12.355	9.999	15.334	12.246	13.256	11.076	16.772	11.671	12.758	12.574	16.720
22	9.860	14.935	12.308	12.701	10.182	15.727	12.573	13.623	11.302	17.234	11.979	13.111	12.935	17.345
23	10.019	15.276	12.608	13.034	10.352	16.100	12.887	13.975	11.514	17.674	12.274	13.449	13.283	17.963
24	10.167	15.599	12.894	13.355	10.510	16.455	13.188	14.312	11.714	18.094	12.557	13.774	13.620	18.576
25	10.304	15.905	13.168	13.664	10.658	16.791	13.476	14.636	11.902	18.495	12.828	14.086	13.944	19.184
26	10.432	16.194	13.431	13.962	10.795	17.110	13.752	14.947	12.079	18.878	13.087	14.386	14.258	19.787
27	10.550	16.468	13.681	14.249	10.923	17.412	14.016	15.245	12.245	19.243	13.335	14.674	14.560	20.383
28	10.660	16.727	13.921	14.525	11.042	17.700	14.269	15.532	12.402	19.591	13.573	14.950	14.852	20.975
29	10.763	16.972	14.150	14.791	11.153	17.972	14.512	15.806	12.549	19.923	13.801	15.215	15.134	21.561
30	10.857	17.204	14.369	15.048	11.256	18.231	14.744	16.070	12.687	20.240	14.019	15.470	15.406	22.143

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors

Table B-9—Uniform Present Worth Factor for DOE Region IX, California, Nevada, Arizona, Hawaii, Trust Territory of the Pacific Islands, American Samoa, Guam

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural Gas	Distillate	Liquid Gas	Electricity	Natural Gas	Distillate	Residual	Electricity	Natural Gas	Distillate	Residual	Liquid Gas	Coal
1	0.932	0.993	0.949	0.946	0.935	0.970	0.953	0.960	0.935	0.993	0.941	0.952	0.953	1.089
2	1.801	1.979	1.850	1.840	1.781	1.912	1.861	1.882	1.809	1.980	1.828	1.857	1.861	2.117
3	2.611	2.958	2.704	2.685	2.573	2.825	2.726	2.768	2.626	2.960	2.662	2.719	2.727	3.237
4	3.366	3.930	3.515	3.484	3.306	3.711	3.551	3.618	3.390	3.934	3.447	3.569	3.552	4.401
5	4.070	4.895	4.285	4.240	3.984	4.571	4.336	4.435	4.104	4.901	4.186	4.320	4.339	5.609
6	4.710	5.793	4.990	4.940	4.600	5.375	5.056	5.184	4.754	5.798	4.864	5.035	5.068	6.731
7	5.292	6.631	5.637	5.588	5.160	6.126	5.716	5.871	5.344	6.630	5.484	5.691	5.744	7.772
8	5.821	7.410	6.229	6.189	5.669	6.828	6.321	6.501	5.881	7.401	6.053	6.293	6.371	8.740
9	6.301	8.136	6.771	6.745	6.132	7.483	6.875	7.079	6.368	8.115	6.575	6.844	6.952	9.683
10	6.738	8.813	7.268	7.260	6.553	8.096	7.383	7.609	6.812	8.778	7.052	7.350	7.490	10.472
11	7.142	9.428	7.744	7.760	6.942	8.654	7.870	8.119	7.223	9.417	7.510	7.836	8.014	11.270
12	7.515	9.989	8.199	8.244	7.303	9.162	8.337	8.608	7.605	10.033	7.950	8.303	8.523	12.033
13	7.859	10.499	8.634	8.714	7.636	9.624	8.785	9.076	7.958	10.626	8.372	8.752	9.019	12.764
14	8.176	10.963	9.050	9.170	7.944	10.046	9.215	9.530	8.287	11.198	8.776	9.184	9.500	13.464
15	8.470	11.386	9.448	9.612	8.228	10.428	9.627	9.965	8.591	11.749	9.164	9.599	9.969	14.133
16	8.741	11.771	9.829	10.040	8.492	10.777	10.023	10.382	8.873	12.281	9.536	9.997	10.424	14.774
17	8.991	12.121	10.193	10.456	8.736	11.095	10.402	10.783	9.135	12.793	9.893	10.381	10.867	15.387
18	9.222	12.440	10.541	10.859	8.961	11.384	10.766	11.168	9.378	13.286	10.236	10.749	11.298	15.974
19	9.435	12.730	10.875	11.250	9.170	11.648	11.115	11.538	9.603	13.762	10.564	11.104	11.717	16.535
20	9.632	12.994	11.194	11.629	9.362	11.888	11.450	11.893	9.812	14.220	10.880	11.444	12.124	17.073
21	9.814	13.234	11.499	11.997	9.541	12.106	11.772	12.235	10.005	14.662	11.182	11.772	12.520	17.587
22	9.982	13.453	11.790	12.353	9.706	12.305	12.080	12.563	10.185	15.088	11.472	12.086	12.906	18.079
23	10.137	13.652	12.069	12.699	9.858	12.486	12.376	12.878	10.352	15.499	11.750	12.389	13.280	18.550
24	10.280	13.834	12.336	13.035	9.999	12.650	12.659	13.181	10.506	15.894	12.017	12.680	13.645	19.001
25	10.412	13.999	12.591	13.360	10.130	12.800	12.931	13.473	10.650	16.276	12.273	12.959	13.999	19.432
26	10.534	14.149	12.836	13.675	10.251	12.937	13.192	13.752	10.782	16.643	12.519	13.228	14.343	19.845
27	10.647	14.286	13.069	13.981	10.362	13.061	13.443	14.021	10.906	16.997	12.754	13.486	14.678	20.240
28	10.751	14.411	13.293	14.278	10.465	13.175	13.683	14.279	11.020	17.339	12.980	13.735	15.004	20.618
29	10.847	14.524	13.506	14.566	10.561	13.278	13.913	14.527	11.126	17.668	13.197	13.973	15.321	20.980
30	10.936	14.627	13.711	14.845	10.649	13.372	14.134	14.766	11.224	17.985	13.405	14.203	15.629	21.326

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Table B-10—Uniform Present Worth Factor for DOE Region X, Washington, Oregon, Idaho, Alaska

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural gas	Distillate	Liquid gas	Electricity	Natural gas	Distillate	Residual	Electricity	Natural gas	Distillate	Residual	Liquid gas	Coal
1	0.918	0.966	0.950	0.944	0.922	0.967	0.955	0.962	0.966	1.000	0.943	0.954	0.957	1.062
2	1.760	1.899	1.853	1.835	1.771	1.903	1.868	1.886	1.899	2.001	1.833	1.865	1.872	2.189
3	2.533	2.800	2.710	2.675	2.554	2.807	2.740	2.775	2.800	3.003	2.672	2.733	2.747	3.386
4	3.242	3.670	3.525	3.469	3.276	3.682	3.572	3.630	3.671	4.005	3.463	3.562	3.585	4.658
5	3.893	4.510	4.299	4.218	3.941	4.529	4.368	4.452	4.511	5.007	4.210	4.353	4.386	6.007
6	4.497	5.289	5.009	4.911	4.558	5.316	5.097	5.206	5.301	5.927	4.894	5.079	5.129	7.238
7	5.056	6.012	5.659	5.554	5.129	6.048	5.765	5.897	6.044	6.771	5.520	5.744	5.817	8.361
8	5.574	6.682	6.254	6.149	5.657	6.728	6.377	6.530	6.742	7.545	6.095	6.354	6.456	9.384
9	6.054	7.304	6.800	6.700	6.147	7.361	6.938	7.111	7.397	8.256	6.621	6.914	7.048	10.318
10	6.500	7.880	7.300	7.210	6.601	7.950	7.452	7.644	8.013	8.908	7.103	7.427	7.596	11.169
11	6.913	8.419	7.778	7.705	7.022	8.502	7.945	8.156	8.593	9.536	7.566	7.921	8.130	11.989
12	7.297	8.923	8.236	8.185	7.413	9.020	8.418	8.650	9.139	10.142	8.010	8.394	8.649	12.780
13	7.654	9.395	8.673	8.651	7.776	9.506	8.872	9.124	9.652	10.726	8.436	8.850	9.153	13.542
14	7.986	9.836	9.092	9.103	8.113	9.962	9.307	9.581	10.137	11.289	8.844	9.287	9.644	14.277
15	8.294	10.248	9.492	9.541	8.426	10.390	9.724	10.020	10.593	11.831	9.236	9.707	10.121	14.985
16	8.581	10.634	9.875	9.965	8.717	10.791	10.125	10.443	11.022	12.354	9.612	10.110	10.585	15.668
17	8.847	10.994	10.241	10.377	8.987	11.168	10.509	10.849	11.425	12.858	9.972	10.498	11.037	16.326
18	9.094	11.331	10.592	10.776	9.238	11.522	10.876	11.241	11.805	13.343	10.318	10.870	11.475	16.960
19	9.324	11.647	10.927	11.164	9.471	11.853	11.231	11.617	12.163	13.811	10.650	11.228	11.902	17.572
20	9.537	11.942	11.248	11.540	9.687	12.165	11.570	11.980	12.500	14.263	10.968	11.571	12.317	18.161
21	9.735	12.217	11.554	11.904	9.888	12.457	11.896	12.328	12.817	14.697	11.273	11.901	12.721	18.729
22	9.919	12.475	11.848	12.257	10.074	12.730	12.208	12.664	13.115	15.116	11.566	12.218	13.113	19.277
23	10.090	12.717	12.128	12.600	10.247	12.988	12.507	12.986	13.396	15.520	11.847	12.523	13.495	19.804
24	10.249	12.942	12.397	12.932	10.408	13.229	12.794	13.297	13.660	15.910	12.116	12.816	13.866	20.313
25	10.397	13.153	12.654	13.255	10.557	13.455	13.070	13.596	13.909	16.285	12.375	13.097	14.227	20.804
26	10.534	13.350	12.899	13.567	10.695	13.667	13.334	13.883	14.144	16.646	12.623	13.367	14.578	21.276
27	10.662	13.535	13.134	13.870	10.824	13.867	13.588	14.160	14.364	16.995	12.861	13.626	14.919	21.732
28	10.780	13.707	13.359	14.164	10.943	14.053	13.831	14.426	14.572	17.331	13.089	13.875	15.251	22.171
29	10.890	13.869	13.574	14.449	11.054	14.229	14.064	14.682	14.767	17.655	13.308	14.115	15.574	22.595
30	10.993	14.020	13.779	14.726	11.157	14.393	14.288	14.928	14.951	17.967	13.518	14.344	15.888	23.003

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Table B-11—Uniform Present Worth Factor for the United States, U.S. Average

Study period	Residential sector				Commercial sector				Industrial sector					
	Electricity	Natural gas	Distillate	Liquid gas	Electricity	Natural gas	Distillate	Residual	Electricity	Natural gas	Distillate	Residual	Liquid gas	Coal
1	0.925	0.959	0.951	0.961	0.926	0.961	0.953	0.971	0.945	1.002	0.944	0.962	0.962	1.030
2	1.781	1.880	1.855	1.884	1.785	1.886	1.862	1.913	1.837	2.005	1.836	1.887	1.886	2.092
3	2.573	2.763	2.715	2.771	2.580	2.774	2.728	2.828	2.681	3.010	2.678	2.777	2.775	3.186
4	3.305	3.611	3.533	3.623	3.317	3.628	3.553	3.716	3.478	4.017	3.473	3.633	3.630	4.314
5	3.982	4.424	4.311	4.442	3.999	4.449	4.340	4.578	4.231	5.026	4.224	4.457	4.452	5.476
6	4.602	5.184	5.032	5.200	4.624	5.220	5.069	5.378	4.923	5.986	4.919	5.221	5.213	6.544
7	5.169	5.896	5.698	5.901	5.195	5.943	5.745	6.121	5.559	6.900	5.563	5.929	5.918	7.526
8	5.688	6.561	6.316	6.551	5.719	6.621	6.370	6.811	6.144	7.770	6.159	6.587	6.572	8.429
9	6.163	7.184	6.888	7.152	6.197	7.258	6.950	7.451	6.682	8.598	6.711	7.197	7.177	9.260
10	6.597	7.766	7.417	7.708	6.636	7.855	7.488	8.046	7.176	9.387	7.223	7.762	7.737	10.023
11	7.000	8.311	7.922	8.244	7.043	8.414	8.002	8.616	7.639	10.134	7.712	8.305	8.279	10.759
12	7.375	8.820	8.405	8.761	7.422	8.939	8.494	9.162	8.074	10.843	8.180	8.825	8.802	11.469
13	7.723	9.296	8.867	9.259	7.774	9.430	8.966	9.685	8.481	11.515	8.628	9.323	9.308	12.153
14	8.047	9.740	9.307	9.739	8.102	9.891	9.417	10.186	8.863	12.152	9.056	9.801	9.797	12.813
15	8.348	10.156	9.728	10.202	8.407	10.323	9.849	10.666	9.221	12.756	9.466	10.260	10.269	13.449
16	8.628	10.545	10.130	10.649	8.690	10.727	10.263	11.126	9.557	13.328	9.858	10.699	10.726	14.063
17	8.888	10.908	10.513	11.079	8.954	11.107	10.659	11.567	9.871	13.871	10.234	11.121	11.167	14.654
18	9.130	11.248	10.880	11.494	9.199	11.462	11.038	11.989	10.166	14.386	10.593	11.525	11.593	15.225
19	9.354	11.565	11.230	11.893	9.426	11.795	11.401	12.393	10.443	14.874	10.936	11.912	12.005	15.774
20	9.563	11.862	11.564	12.279	9.638	12.107	11.749	12.781	10.702	15.336	11.265	12.284	12.403	16.305
21	9.757	12.140	11.884	12.650	9.835	12.400	12.082	13.152	10.946	15.775	11.579	12.640	12.788	16.816
22	9.937	12.399	12.189	13.009	10.018	12.674	12.400	13.508	11.174	16.191	11.880	12.981	13.159	17.308
23	10.104	12.642	12.480	13.354	10.189	12.931	12.705	13.849	11.387	16.585	12.167	13.309	13.519	17.784
24	10.260	12.868	12.758	13.687	10.347	13.171	12.997	14.175	11.588	16.959	12.443	13.623	13.866	18.242
25	10.405	13.080	13.024	14.008	10.495	13.397	13.276	14.488	11.776	17.313	12.706	13.924	14.201	18.684
26	10.539	13.278	13.278	14.317	10.632	13.609	13.544	14.788	11.952	17.649	12.958	14.212	14.525	19.110
27	10.664	13.463	13.520	14.615	10.759	13.807	13.800	15.075	12.117	17.968	13.199	14.489	14.839	19.520
28	10.780	13.637	13.751	14.903	10.877	13.993	14.045	15.350	12.272	18.270	13.430	14.754	15.141	19.916
29	10.888	13.798	13.973	15.180	10.988	14.167	14.280	15.614	12.417	18.556	13.650	15.009	15.434	20.298
30	10.989	13.950	14.184	15.447	11.090	14.330	14.505	15.867	12.553	18.827	13.862	15.253	15.717	20.666

These uniform present worth factors are based on a 10 percent discount rate adjusted for energy price escalation. See Appendix C for price projections used in developing the factors.

Appendix C to Subpart A of Part 436

Table C-1—Base Year Energy Prices (1980 Prices Per Million Btu in 1980 Dollars)

Fuel type	DOE 1	DOE 2	DOE 3	DOE 4	DOE 5	DOE 6	DOE 7	DOE 8	DOE 9	DOE 10	Average
Residential Sector											
Electricity	17.95	20.75	15.67	12.53	14.58	14.02	13.76	12.23	15.46	6.49	14.17
Natural gas	5.14	4.25	3.55	3.00	3.05	3.07	2.74	2.61	2.98	4.04	3.24
Distillate	4.49	4.46	4.51	4.44	4.21	4.09	4.15	4.19	4.36	4.33	4.38
Liquid gas	5.12	5.09	5.12	4.89	4.69	4.53	4.58	4.91	4.55	4.58	4.73
Commercial Sector											
Electricity	17.66	20.52	15.17	12.85	14.24	12.81	12.73	10.52	14.42	6.56	14.14
Natural gas	4.41	3.71	3.26	2.60	2.75	2.40	2.28	2.33	2.92	3.50	2.84
Distillate	4.17	4.19	4.18	4.09	4.00	3.86	3.94	3.90	4.02	3.97	4.07
Residual	3.24	3.17	3.26	2.94	3.39	2.88	3.03	3.03	3.24	3.16	3.20
Industrial Sector											
Electricity	13.40	11.94	10.74	8.54	9.61	9.21	9.51	6.61	11.74	2.82	9.38
Natural gas	3.78	3.16	2.79	2.18	2.61	1.83	1.95	1.86	2.77	2.81	2.21
Distillate	4.44	4.43	4.47	4.39	4.25	4.11	4.20	4.15	4.26	4.22	4.30
Residual	3.44	3.42	3.42	3.18	3.58	3.03	3.27	3.14	3.40	3.39	3.33
Liquid gas	4.85	4.84	4.90	4.61	4.50	4.35	4.40	4.66	4.14	4.07	4.51
Coal	1.69	1.36	1.17	1.23	1.10	1.29	1.11	0.79	1.21	1.02	1.15

Table C-2—Base Year Energy Prices (1980 Prices Per Unit of Energy Purchased in 1980 Dollars)

Fuel type and unit purchased	DOE 1	DOE 2	DOE 3	DOE 4	DOE 5	DOE 6	DOE 7	DOE 8	DOE 9	DOE 10	U.S. average
Residential Sector											
Electricity (Kwh)	0.061	0.071	0.053	0.043	0.050	0.048	0.047	0.042	0.053	0.022	0.048
Natural gas (cubic foot)	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.003	0.004	0.003
Distillate (gallon)	0.622	0.618	0.626	0.615	0.584	0.568	0.576	0.581	0.604	0.600	0.608
Liquid gas (gallon)	0.489	0.486	0.489	0.467	0.448	0.433	0.437	0.469	0.434	0.437	0.452
Commercial Sector											
Electricity (Kwh)	0.060	0.070	0.052	0.044	0.049	0.044	0.043	0.036	0.049	0.022	0.048
Natural gas (cubic foot)	0.005	0.004	0.003	0.003	0.003	0.002	0.002	0.002	0.003	0.004	0.003
Distillate (gallon)	0.579	0.581	0.580	0.568	0.555	0.535	0.546	0.541	0.557	0.550	0.564
Residual (gallon)	0.485	0.474	0.488	0.440	0.508	0.431	0.454	0.454	0.485	0.473	0.479
Industrial Sector											
Electricity (Kwh)	0.046	0.041	0.037	0.029	0.033	0.031	0.032	0.023	0.040	0.010	0.032
Natural gas (cubic foot)	0.004	0.003	0.003	0.002	0.003	0.002	0.002	0.002	0.003	0.003	0.002
Distillate (gallon)	0.616	0.615	0.620	0.609	0.580	0.570	0.582	0.576	0.591	0.585	0.597
Residual (gallon)	0.515	0.512	0.512	0.476	0.536	0.454	0.489	0.470	0.508	0.507	0.498
Liquid gas (gallon)	0.464	0.462	0.468	0.441	0.430	0.415	0.421	0.445	0.395	0.388	0.431
Coal (ton)	41.456	33.299	28.630	30.202	27.010	31.493	27.155	19.255	29.587	24.985	28.188

Table C-3—1985 Projected Energy Prices

Fuel	DOE 1	DOE 2	DOE 3	DOE 4	DOE 5	DOE 6	DOE 7	DOE 8	DOE 9	DOE 10	U.S.
Residential Sector											
Electricity	19.25	20.59	16.60	13.67	15.74	17.63	14.57	13.86	17.53	6.80	15.47
Natural gas	5.85	4.90	4.33	3.82	3.97	4.18	3.67	4.13	4.64	5.47	4.25
Distillate	5.46	5.55	5.77	5.85	5.22	5.47	5.15	5.25	5.40	5.40	5.49
Liquid gas	6.24	6.34	6.71	6.73	6.14	6.19	5.98	6.31	6.53	5.39	6.25
Commercial Sector											
Electricity	18.86	20.68	16.71	14.11	15.51	16.49	13.85	12.37	16.74	7.03	15.53
Natural gas	5.07	4.20	3.79	3.22	3.58	3.57	3.20	3.86	4.04	4.78	3.75
Distillate	5.17	5.25	5.91	5.81	5.00	5.17	4.94	4.96	5.08	5.08	5.16
Residual	4.35	4.46	4.80	4.66	4.38	4.37	4.41	4.18	4.26	4.18	4.44
Industrial Sector											
Electricity	14.89	12.83	12.20	10.33	11.36	13.44	10.87	8.74	18.49	3.82	11.37
Natural gas	4.71	4.69	3.76	3.09	3.86	3.22	3.32	3.92	4.81	4.54	3.59
Distillate	5.17	5.24	5.41	5.40	5.00	5.15	4.93	5.02	5.08	5.08	5.20
Residual	4.41	4.57	4.71	4.91	4.36	4.36	4.38	4.13	4.26	4.92	4.41
Liquid gas	5.96	6.03	6.27	6.32	5.94	5.94	5.80	6.05	5.24	5.24	5.96
Coal	2.56	2.40	2.26	2.38	2.04	2.18	1.91	1.39	2.66	2.22	2.16

Fuel prices per million Btu in 1980 dollars.
Prices based on DOE Mid Range Energy Forecasting System (MEFS) Projection Series "B" (High Case).

Table C-4—Projected 1990 Energy Prices

Fuel	DOE 1	DOE 2	DOE 3	DOE 4	DOE 5	DOE 6	DOE 7	DOE 8	DOE 9	DOE 10	U.S.
Residential Sector											
Electricity	19.16	20.66	17.16	14.37	16.44	18.86	14.45	13.21	17.53	7.49	15.96
Natural gas	6.40	5.86	5.01	4.20	4.53	4.99	4.54	4.73	5.24	6.04	4.91
Distillate	5.98	6.08	6.28	6.37	5.78	6.00	5.67	5.80	5.62	5.62	6.02
Liquid gas	6.78	6.88	7.25	7.27	6.75	6.80	6.60	6.91	6.06	6.06	6.83
Commercial Sector											
Electricity	18.76	20.75	16.27	14.82	16.20	17.72	13.71	11.71	15.74	7.72	16.06
Natural gas	5.62	5.16	4.47	3.60	4.14	4.37	4.06	4.06	4.46	5.35	4.39
Distillate	5.70	5.78	5.82	5.84	5.56	5.70	5.47	5.54	5.29	5.29	5.67
Residual	4.83	4.94	5.30	4.85	4.93	4.86	4.92	4.73	4.46	4.37	4.93
Industrial Sector											
Electricity	14.80	12.90	12.76	11.04	12.05	14.66	10.74	8.07	13.49	4.51	12.03
Natural gas	5.23	5.22	5.22	5.01	5.14	4.02	5.08	3.91	4.76	4.76	4.52
Distillate	5.70	5.76	5.94	5.93	5.56	5.67	5.46	5.58	5.29	5.29	5.71
Residual	4.90	5.06	5.20	4.80	4.90	4.85	4.87	4.68	4.45	4.52	4.88
Liquid gas	6.50	6.57	6.81	6.86	6.55	6.55	6.42	6.66	5.78	5.78	6.55
Coal	2.79	2.63	2.48	2.46	2.14	2.18	1.99	1.42	2.63	2.26	2.28

Fuel prices per million Btu in 1980 dollars.
Prices based on DOE Mid Range Energy Forecasting System (MEFS) projection series "B" (High Case).

Table C-5—1995 Energy Prices

Fuel	DOE 1	DOE 2	DOE 3	DOE 4	DOE 5	DOE 6	DOE 7	DOE 8	DOE 9	DOE 10	U.S.
Residential Sector											
Electricity	21.19	2.37	19.29	16.34	18.78	20.93	15.82	14.70	18.95	8.35	17.82
Natural gas	7.02	6.71	5.65	4.94	5.34	5.86	5.54	5.79	5.27	6.96	5.64
Distillate	7.64	7.75	7.97	8.05	7.47	7.67	7.35	7.47	7.25	7.25	7.70
Liquid gas	9.09	9.21	9.56	9.58	9.07	9.13	8.99	9.23	8.38	8.38	9.16
Commercial Sector											
Electricity	20.90	22.46	18.39	16.80	18.54	19.79	15.10	13.21	17.16	8.58	17.99
Natural gas	6.24	6.01	5.11	4.35	4.96	5.24	5.06	5.53	4.67	6.27	5.11
Distillate	7.35	7.45	7.51	7.51	7.26	7.37	7.14	7.20	6.91	6.91	7.35
Residual	6.31	6.42	6.78	6.34	6.43	6.36	6.42	6.20	5.88	5.80	6.41
Industrial Sector											
Electricity	16.83	14.62	14.88	13.01	14.39	16.73	12.13	9.57	14.92	5.37	14.03
Natural gas	6.83	6.83	6.83	6.81	6.76	4.90	6.71	4.98	6.37	6.37	5.57
Distillate	7.35	7.43	7.62	7.61	7.25	7.35	7.14	7.25	6.91	6.91	7.37
Residual	6.37	6.53	6.68	6.31	6.40	6.35	6.39	6.14	5.88	5.95	6.37
Liquid gas	8.82	8.90	9.13	9.17	8.87	8.86	8.80	8.99	8.09	8.09	8.89
Coal	3.61	3.45	3.30	3.28	2.91	2.96	2.76	2.19	3.39	3.03	3.06

Fuel prices per million Btu in 1980 dollars.
Prices based on DOE Mid Range Energy Forecasting System (MEFS) projection series "B" (High Case).

[Docket No. CAS-AM-79-107]

[FR Doc. 79-13243 Filed 4-27-79; 8:45 am]

BILLING CODE 6450-01-M